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Financial Management

ECONOMIC ANALYSIS

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This manual implements AFI 65-501, *Economic Analysis*, by providing information on conducting economic analysis (EA) to support Air Force management decisions.

SUMMARY OF REVISIONS

This is the initial publication of AFMAN 65-506, revising AFP 178-8, *Economic Analysis Procedures Handbook*, 19 May 1981. It updates previous economic analysis procedures. The Air Force no longer requires an installation Economic Resource Impact Statement. An annual economic analysis report is now required for certain organizations. This manual provides principles for estimating economic impact if a command or installation commander requires such analysis.

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Chapter 1

ECONOMIC ANALYSIS PRINCIPLES

1.1. Economic Analysis:

1.1.1. Economic analysis (EA) is a method of making rational decisions among alternatives. When a commander or manager must make a choice between two or more options, an EA improves the decision making process. A glossary of EA terms is at attachment 1. EAs can facilitate the following kinds of programs, products, and activities:

- MILCON and military family housing.
- Tradeoffs between force structures, force size, modernization and readiness.
- Projects to mechanize, automate, prevent obsolescence, improve work flow and layout, or increase capacity.
- Repairing, modifying or replacing weapon systems.
- Acquiring or upgrading equipment to reduce operating and support costs.
- Lease or purchase of general purpose real property, such as, office buildings, warehouses, and associated land.
- Consolidating facilities, such as warehouses, maintenance and storage depots, and repair activities to decrease cost for any reason or to add to mission effectiveness.
- Purchase or lease of productivity enhancing equipment.
- Use of one-time contract consultants or use of outside civilian services instead of in-house resources.
- Total quality management efforts.
- Business process improvement (business reengineering).

1.1.2. EAs assist commanders and managers in allocating scarce resources. Analysts assigned to EAs ensure that they probe the scope of the project so that all relevant questions are considered. Asking questions is the best way to ensure that all perspectives are covered. The analyst ensures that the objective and all alternatives are clearly defined; costs and benefits are completely presented; and important assumptions, factors, and judgments are highlighted. The emphasis should always be on quality analysis rather than length -- length does not necessarily indicate quality. Aim for a concise, clearly written, EA so that reviewers and senior management can easily follow the analysis. Achieve a quality EA through a cooperative effort involving both comptroller and functional personnel. Advance planning by functional and comptroller offices is necessary to complete a timely EA. This requires early clarification of the tasking and a thorough exchange of information. AFI 65-501, paragraph 1.2, states requirements for EAs. A Request for Waiver from an EA is at attachment 2.

1.1.3. Initiate an EA as early as possible and update any information as significant developments occur which would invalidate or significantly alter the cost-benefit relationships underlying previous analyses. As you prepare EAs update them to include developments such as:

- Actual performance data at variance with predicted performance data.
- Major changes in initial study assumptions.
- New alternatives which satisfy the stated requirements more effectively or efficiently.

1.1.4. The depth and formality of EAs should be commensurate with the magnitude of the resources involved. The analyst must exercise judgment here. Additional information on the principles of economic analysis is available in numerous sources:

- The Base Level Cost Analysis Handbook, Chapter 11, "Economic Analysis," discusses the EA process.
- Manuals published by civil engineering provide factors and special features for MILCON and Military Family Housing (MFH) EAs. Consult your civil engineering office for the most recent edition.
- College textbooks discuss financial concepts such as internal rate of return, net present value, etc.
- PC ECONPACK is a software program developed by the Army Corps of Engineers for MILCON and MFH EAs, though it may also be used for other types of EAs. Command financial analysis offices may contact SAF/FMCE for information on obtaining PC-ECONPACK.
- The Institute for Defense Analysis' (IDA) Business Case Analysis Model assists in preparing functional economic analyses (FEA) supporting major automated information systems. Contact SAF/FMCE for information.
- SAF/FMCE has developed a computer based training program, "How to Prepare an Economic Analysis." This program allows new analysts to learn about the EA process at their own pace. The program also serves as a refresher for experienced analysts who may not have worked on an EA for some time. Contact SAF/FMCE to request a copy.
- "The Economic Analysis System" is a computer program which may be useful for preparing non-MILCON, non-MFH EAs. Contact SAF/FMCE for details.

NOTE:

Users of computer programs must keep in mind that the most crucial part of an EA is carefully considering the reasonableness of assumptions underlying an analysis. Also, spreadsheets identifying costs must be accompanied by documentation of the derivation of the costs.

1.2. Elements of an Economic Analysis:

1.2.1. Economic analysis (or cost-benefit analysis) is a method for systematically comparing competing project alternatives. For the purposes of this instruction, an economic analysis and a cost-benefit analysis are the same thing. Cost is but one criterion on which project selection should be based; economic analysis offers a means of systematically assessing both monetary and non-monetary costs and benefits across alternatives. Identification and valuation of costs and benefits structure the whole analysis; therefore, it is essential that these processes be conducted according to sound methodology and good common sense. The guidelines below are designed with this principle in mind.

1.2.2. Each economic analysis must include at least the following:

- *Executive Summary.* Summarize the analysis, including the recommendation. Include the name and location of the installation, project objective and scope, alternatives, discounted life cycle costs and cost-benefit ratios (if applicable) for each alternative, and a recommendation with a brief discussion of relative benefits. We recommend limiting the executive summary to one page. The format for an executive summary is outlined at attachment 3.

- *Certificate of Satisfactory Economic Analysis.* This page shows coordination of comptroller and functional offices. See paragraph 1.4 and attachment 4. A certification checklist is at attachment 5. An example statement of nonconcurrency is at attachment 6.
- *Objective.* State the problem or objective (i.e., mission or mission support requirement) to be met by the alternatives under study.
- *Assumptions.* State the assumptions, criteria, ground rules, constraints and variables which influence cost and effectiveness, such as required operational readiness dates, base year of the analysis, use of constant or current dollars, age of existing facilities, assumptions about future energy prices, etc. Since each EA will have unique assumptions, and assumptions drive cost estimating methodology, carefully consider the assumptions underlying your analysis.
- *Alternatives.* List the alternatives considered to meet the objective. If alternatives to current programs are covered in the analysis, then include the status quo/baseline as a separate alternative. Often the baseline is some upgrade of the existing situation. Thoroughly describe each feasible alternative that could fulfill the program or project objective. Explain in the description of alternatives how each process or procedure would work; what personnel, equipment, or facilities would be required; and what other changes would be involved. Identify any alternative judged infeasible and document the grounds for its rejection. It is not necessary to include the costs or benefits of infeasible alternatives--however, do not base infeasibility on costs. Include in the EA's coordination process any functional offices which can attest to the infeasibility of a particular alternative.
- *Life Cycle Cost Analysis.* Include the total life cycle costs of each feasible alternative in the analysis. Include the costs of all resources required for each feasible alternative. Paragraph 1.4 provides further guidelines for estimating costs.
- *Life Cycle Benefits Analysis.* Include the benefits of each feasible alternative in the analysis. If possible, quantify benefits. When benefits cannot be quantified, include a narrative description of benefits. When benefits can be quantified, calculate a cost-benefit ratio. Paragraph 1.4 provides further guidelines for estimating benefits.
- *Sensitivity Analysis.* Assess the risk to the recommendation resulting from possible changes of key variables. See paragraph 1.8 for discussion of this analysis.
- *Recommendation.* Briefly summarize each alternative and recommend a course of action. Compare the relative strengths and weaknesses of each alternative and identify the most effective alternative accomplishing the mission objective. Briefly compare all monetary and non-monetary costs and benefits. Since the recommended course of action may not always be the alternative with the lowest total cost, clearly state the recommended alternative and reasons for the recommendation.

NOTE:

A guide for preparing EAs is at attachment 7. This guide is helpful when planning an EA, when finally reviewing an EA before forwarding, or for reviewers at later stages of the project proposal process. Consult paragraph 1.9 for documentation requirements for an EA.

1.3. The Economic Analysis Process:

1.3.1. Define the Objective. The first step in an economic analysis is to define the objective or state the problem. A problem will not be solved if it is not first clearly and accurately stated. The statement of the problem sets the framework for the whole analysis. While the statement of the problem should be as clear as possible, it should not slant the solution to the problem toward any one particular alternative or possible solution. Remain flexible about the statement of the problem as the analysis progresses. As you learn more about the issues involved, new information may influence the problem statement and possible alternatives. The most important thing to consider is whether the objective actually addresses the problem or whether it identifies a symptom of the problem. This is important because if the objective addresses a symptom, the overall problem will not be solved. *For example,* assume that a wing has problems maintaining 90 percent of its planes in a mission ready capacity. A good objective would emphasize the need to improve the mission ready capability of the wing, thereby ensuring that the actual problem is included in the analysis. It is thus very important that the objective statement be broad enough to cover the real problem but accurate enough to precisely state the problem.

1.3.2. Examine Assumptions. An analyst must make assumptions throughout the course of an economic analysis. Assumptions provide the groundwork for stating the problem and establishing alternatives. Since assumptions cannot be avoided, an analyst must include a complete list of assumptions along with their rationale. The important criterion here is that assumptions are reasonable in view of either historical data, economic forecasts, or planned changes in programs or operations.

1.3.2.1. Types of assumptions. There are two basic types of assumptions:

- *State-of-nature assumptions* set the limits of the analysis and permit the analyst to screen which alternatives are feasible. Their inclusion in the analysis is crucial since they permit the decision maker to understand and question both the limits and the construction of alternatives.
- *Mathematical assumptions* involve calculation procedures used to derive cost and benefit factors. When the analyst uses procedures that involve assumptions (for example, to apportion cost, determine manning factors, set inventory levels, or calculate inflation factors), the methodology behind these procedures must be fully defined. Assumptions must be based on sound rationale and justified as part of the analysis process. The use of cost factors from official sources, such as AFI 65-503, is encouraged.

1.3.2.2. Often assumptions include forecast values. Since no one has a crystal ball to see into the future, we must check to see whether changes in the values forecast for key variables would make significant changes in our final conclusions. Sensitivity analysis is the procedure for ascertaining the effects on the bottom line due to possible variations in forecast values. See paragraph 1.8.

1.3.3. Determining Alternatives. The third step in economic analysis is to examine the various alternatives available to meet the objective. Aggressive pursuit of alternatives is critical since the final decision can be no better than the available choices. Throughout the economic analysis, the analyst should continually consider, in consultation with functional representatives, accepting new alternatives and discarding old ones.

1.3.3.1. Types of Alternatives. Alternatives considered may include:

- Repair or replace.
- Buy or lease.

- Use manpower or machine.
- Make or buy.
- Centralize or decentralize.
- Other options unique to the situation.

1.3.3.2. Number of Alternatives. An EA always addresses at least two alternatives. One is often the existing system (status quo) or an upgraded version (baseline case). The baseline alternative and its costs and benefits can serve as a common reference point in the analysis. The interpretation of costs and benefits of all other alternatives, and perhaps even their derivation, may depend on the base case used. It is usually crucial to construct a proper baseline alternative. Other proposed alternatives in an EA come from two main sources:

- Supporters of some particular alternative or critics of the current process in use.
- The skill and experience of the program manager, analyst, or support staff.

The traditional, conventional, or seemingly most plausible alternative is not the only way. Avoid the trap of excluding imaginative alternatives merely because they run contrary to past practice, organizational operating policies, or even administrative regulations and current law, since it may be possible to change these conditions. As more is learned, new alternatives can be more valuable than an exhaustive comparison of existing ones, none of which may be very satisfactory. The invention of imaginative alternatives, which is the responsibility of both the program manager and the analyst, may involve consideration of non-Air Force capabilities or mixtures among individual Air Force systems. *For example*, a study of a data processing requirement might lead to an alternative which establishes a regional computer system to meet your requirements and those of nearby Army installations or offices of other federal agencies in the area. Keep the number of alternatives under consideration at a manageable level. Eliminate possible alternatives which fail to meet the objective, but include the fact that you considered such alternatives and the reason(s) you dismissed them. Develop into a full analysis of costs and benefits all feasible alternatives which achieve the objective.

1.3.3.3. Private Sector Sources. Base private sector alternatives to the extent possible on estimates provided from business sources or requests for information. Consult and coordinate with contracting offices to develop such alternatives to ensure that private sector sources understand that the government is seeking information and not offering a contract. Analyses which do not include such estimates are often referred to as feasibility studies and are not, strictly speaking, economic analyses. In the absence of such specific information, the study is answering the question of how much a private sector alternative could cost to be competitive with alternatives using government resources, rather than answering the question of what the recommended course of action should be based on the best estimate of costs obtainable. Protect EAs containing contractor sensitive information through procedures required by contracting offices.

1.3.3.4. Government Sources. Coordinate EAs containing alternatives based on government resources with the Air Force offices which provided any cost data or estimates, or have responsibility for the areas covered by the analysis.

1.4. Costs and Benefits. Address both monetary and nonmonetary costs and benefits. Categorize costs and benefits for each alternative according to whether they are monetary or not.

1.4.1. Monetary costs and benefits are those which take the form of specific financial outlays or receipts. The list of costs for each alternative should be exhaustive, but care must be exercised to ensure against double counting. Monetary benefits (such as the proceeds from the sale of assets, lease fees, etc.) should be thoroughly documented. The "Format A" for each alternative (attachment 8) includes the calculation of discounted net costs (i.e., monetary costs minus monetary benefits).

NOTE:

Formats in attachment 8 are optional. Select the formats which best present information for your analysis. Also, you may modify formats to tailor them to the needs of each EA. See paragraph 1.9.4 for recommendations on formats.

1.4.2. Nonmonetary costs and benefits cannot readily be stated in dollar terms. For example, a non-monetary cost could be a reduction of capability or performance brought about by the selection of a particular alternative; similarly, a nonmonetary benefit could be an enhancement of capability or performance. Those nonmonetary costs and benefits which lend themselves to direct quantitative measurement should be compared on that basis. Degradations to or enhancements of other programs should be included as nonmonetary costs or benefits. The "Format B" (attachment 8) is used to summarize nonmonetary costs and benefits for each alternative.

1.4.3. Attachment 9 contains additional information on monetary and nonmonetary costs and benefits.

1.4.4. Ordinarily include a benefits analysis in an EA; quantify benefits when practicable, and calculate a cost-benefit ratio. When you cannot quantify benefits, include a discussion of the benefits. Attachment 9 contains additional information.

1.5. Inflation. Inflation is a rise in the general level of prices. Costs of resources change from year to year. Consult AFI 65-502 for guidance on inflation.

1.5.1. Constant Dollar Analysis. A constant dollar reflects the value or purchasing power of a dollar in a specific year, e.g. constant FY96 dollars. Ordinarily use constant dollars of the fiscal year in which there would first be a difference in expenditures among alternatives (often referred to as the base year, program year, or project year).

1.5.1.1. Adjustment to the Base Year. Since EAs propose a future course of action, the base year is usually one or more years in the future. In a constant dollar analysis, this ordinarily requires an adjustment from the year in which costs or factors are based to the base year of the proposed project. Use USAF raw inflation indices to adjust from the base year of the costs to the base year of the analysis. After adjustment to the base year, the costs would be the same for each of the outyears in the analysis (provided there are no requirement changes or escalation because of, for example, a building requiring more maintenance because of its age). No further inflation adjustment is necessary unless the analysis contains resources that are subject to differential price changes.

1.5.1.2. Differential Price Changes. Even in a constant dollar analysis, you may need to adjust the costs of some elements if economists project price changes significantly above or below general inflation. The "core" rate of inflation, for example, excludes food and energy costs, which are two of the most volatile sectors of the economy. Also, for many years the cost of computer systems has been decreasing relative to increasing processing capability. If an EA contains food,

energy, or computer system costs, adjustments to costs in the outyears may be advisable. Department of Energy indices, which are optional and loaded on the Financial Management Analysis Bulletin Board (FMABB), are net of general inflation--i.e., they only represent how energy costs are projected to vary above or below general inflation. For EAs with food or computer system costs, command headquarters may consult SAF/FMCE for a sector-specific inflation index. Any other costs in an EA which are a significant cost and which represent a volatile sector of the economy in terms of sector-specific inflation may require application of a sector-specific index. Command headquarters may consult SAF/FMCE for information on such indices.

1.5.2. Current Dollar Analysis. A current (or then-year) dollar contains implicit adjustment for variation in the purchasing power of a dollar over time. Current dollars represent amounts that will be paid for resources in the actual years in which payments will be made (therefore sometimes referred to as budget dollars).

1.5.2.1. Do EAs in current dollars when:

- Cost information is obtained in inflated dollars.
- Using the Institute for Defense Analysis' (IDA) model for functional economic analyses (FEA).
- Doing a nonappropriated fund (NAF) construction project analysis.

NOTE:

For FEAs and NAF projects, the functional office is the office of primary responsibility (OPR) for the EA and the comptroller is an office of collateral responsibility (OCR) (see AFI 65-501, paragraph 1.3.5.3).

1.5.2.2. In current dollar analyses all outlays are escalated for inflation using the most appropriate indices. In principle the USAF weighted inflation indices are used to establish current dollar amounts. In the case of leases, however, if all lease payments for a project will be made within the fiscal year, then USAF raw inflation indices should be used. Weighted inflation indices are based upon outlay rates, which are based on historical average expenditure profiles by budget account. However, if more specific information is known about when amounts will be spent for a particular project, then the amounts should be placed in the appropriate year and inflated with raw inflation rates. Also, no weighted indices exist for pay and fuel categories because the assumption in the Air Force inflation indices is that these categories are expended within one fiscal year. If specific data is known about prices of a given acquisition or contract provision, these specific price increases should be used rather than the inflation indices.

1.5.3. Do not mix constant and current dollars in the same analysis.

1.5.4. More specific guidance on inflationary adjustments is contained in AFI 65-502, *Inflation*. In addition, a computer model, the Air Force Inflation Tutorial, is available from SAF/FMCE. This model, based in EXCEL or LOTUS, is both an educational tool and a program for the experienced analyst to quickly accomplish conversions into different types of dollars or into different base years. We strongly recommend this model for inflation adjustments involving Air Force inflation indices since it is user-friendly, accomplishes conversions faster than manual calculations, and has the important feature of not allowing procedural mistakes.

1.6. Discounting and Present Value. Discounting is a financial management tool used to determine the value today (present value) of resource flows over the life of a program or project. Discounting, or

present value analysis, explicitly takes into account the fact that a resource gain or outlay in the future is less valuable than the same sum today. In the simplest analogy, this is because individuals or organizations can borrow or lend at a positive interest rate. For example, if you had a debt of \$1000 due 1 year in the future, and you could get an interest rate of 10 percent (very high compared to most historical periods, but used for simplicity of the example), then you would need only \$909.09 today to meet that obligation. This is because \$909.09 can be loaned for 1 year to produce principal plus interest of \$1000 (in this case simple interest, i.e., not compounded).

NOTE:

Do not confuse discounting with inflation. Discounting involves the concept of the time value of money in view of the interest that can be earned on financial instruments such as treasury securities or commercial time deposits. Inflation involves changes in prices level. While expectations of inflation influence interest rates, the concepts of inflation and the time value of money are separate ideas.

1.6.1. Discount Rate. EAs are accomplished using discount rates representing the government's cost of borrowing, as provided annually in the President's Budget and Appendix C to OMB Circular A-94. Rates used for analysis are interest rates on Treasury notes and bonds with maturities of 3, 5, 7, 10 and 30 years. The rate to be used corresponds to the period of analysis. For periods of analysis between these specific maturities, interpolate between the rates. Though the yield curve is curvilinear and not linear, linear interpolation is acceptable for estimating purposes. Interest rates on Treasury securities are cited on both a real and nominal basis. Ordinarily EAs use a real rate, consistent with a constant dollar analysis. When inflated dollars are used in an EA, then the nominal rate is used. (See paragraph 1.5 on the treatment of inflation.) The discount rates for use in EAs are updated annually on FMABB. Conduct sensitivity analysis on the discount rate at plus and minus 25 per cent of the rate used. Should the sensitivity analysis result in a change in the ranking of life cycle costs, report the rate at which the reversal occurs.

1.6.2. Midyear Factors. We recommend midyear, rather than end-of-year, discount factors for Air Force EAs. Midyear factors approximate actual disbursement patterns--i.e., funds are typically disbursed throughout a given fiscal year rather than at its beginning or end. When the precise timing of outlays is critical to program evaluation, monthly (or quarterly) rather than annual flows of funds may be considered for early program years.

Other discount rates may prevail when evaluating energy projects, depending upon specific legislation. Consult the civil engineers when preparing energy projects. Attachment 10 contains the formula for generating discount factors.

1.7. Economic Life. The economic life of a project or asset is the time during which benefits from the project or asset may reasonably be expected to accrue to the Air Force. Economic life plus project lead-time determine the period of analysis for an EA. The first year in which there is a difference among expenditures for alternatives is the base year, or "project year 1" of the analysis. If early product availability is an important consideration, discuss this when analyzing nonmonetary benefits, or develop in the weighting scheme of a cost-benefit ratio.

1.7.1. The economic life of a project or asset is set by the shortest of its physical life, technological life, or mission life. Physical life of a project is the number of years a facility or piece of equipment will be available for use before it wears out. Technological life is the period before improved technology makes an asset obsolete. Mission life is the time period of program use or operation. For cases

where the Air Force needs the project for a shorter time period than either the technological or physical life, mission life becomes the project economic life.

1.7.2. Terminal value, residual value and salvage value are frequently referred to as the estimated value of existing assets at the end of their economic life. To be precise, these three terms have different meanings. Terminal value is the value of an asset at the end of its economic life. Residual value is the value of an asset any time before the end of its economic life. Salvage value is the value of an asset at the end of its physical life. In other words, the salvage value is the scrap value of the asset at the end of its physical life. The appropriate concept to use in a particular EA depends upon the circumstances of the project, such as the period of analysis and the economic life of the assets employed. A straight-line depreciation method is acceptable for estimating terminal, residual or salvage value. Using such a method is not depreciation in the normal financial sense, but merely using the method for estimating purposes. EA methodology does not depreciate in the normal financial sense because we include the acquisition cost of assets in the period they will be acquired rather than taking a depreciation charge over numerous periods. The only consideration in EAs for depreciation in the financial sense is when there are special tax advantages to lessors taking accelerated depreciation (attachment 12).

1.7.3. The economic life of assets can frequently be found in functional area directives for planning, programming, and budgeting for resources. For example, Air Force A-76 guidance provides estimates of economic lives for selected assets. The DoD Accounting Handbook also provides estimates of economic life.

1.7.4. In EAs alternatives often have the same economic lives. This is the simplest case since costs and benefits can be compared for the same time period. If the alternatives do not have equal lives, there are three approaches for comparing assets of different lives:

- The terminal value method.
- The common denominator method.
- The uniform annual cost method.

1.7.4.1. The terminal value method sets the period of the analysis to the duration of the alternative with the shortest economic life. To calculate the present value of each alternative under this approach, the analyst needs to know the terminal or "salvage" values of the assets for the alternative with the shortest life and the residual values of the asset(s) for the alternative(s) with longer economic life (lives). The terminal/residual values of assets are included as benefits (i.e., inflows, or negative dollar amounts) in the final period cash-flows for each alternative. This step adjusts the present value of the net cash flow for the disparity between the lives of the alternatives. The terminal value method is most commonly used in Air Force EAs.

1.7.4.2. The common denominator method assumes the assets associated with each alternative are replaced in the last year of their lives with identical equipment. Chaining is continued until all alternatives have assets reaching the last year of their lives during the same year. To illustrate this approach, suppose an analyst must choose between two machines, A and B. The two machines are designed differently, but have identical capacity and do exactly the same job. Machine A costs \$10,000 and will last 3 years. It costs \$2000 per year to run. Machine B costs \$6000, but it will last only 2 years and cost \$3000 per year to run. Because the two machines produce exactly the same product, the only way to choose between them is on the basis of cost. If the analyst assumes

that each machine is always replaced at the end of its life with identical equipment, the undiscounted cash-flows are:

Costs, Thousands of Dollars						
	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6
Chain of Type A						
Machines	12	2	2	12	2	2
Chain of Type B						
Machines	9	3	9	3	9	3

Note: By year 6, the second machine under Alternative A wears out, as does the third machine under Alternative B. At this point, the two chains overlap. A replacement must be made after year 6 regardless of the initial choice of Alternatives A or B. The present value comparison below shows a sequence of Type A machines to be cheaper (discounted at a 2.4 percent, mid-year rate):

Present Value Cost, Thousands of Dollars

Chain of Type A machines	30.3
Chain of Type B machines	33.8

The analyst can usually handle the problem of differing lives by the common denominator approach. However, always keep in mind the major assumption being made: that chaining the assets for each alternative, until eventually the assets under each alternative must be replaced in the same period, describes a realistic investment strategy. This approach is not recommended for use with an asset having a short technological life (e.g., computer hardware and software).

1.7.4.3. Another method to compare alternatives with unequal lives is the uniform annual cost (UAC) method. UAC is calculated by dividing the present value of the costs of an alternative by the sum of the discount factors for the periods covering the life of each alternative. The following is an example of two alternatives with different economic lives analyzed using a UAC approach (discounted at a 2.7 percent, mid-year rate):

Yr	PV factor	Model A		Model B	
		Cost	PV	Cost	PV
1	.9868	\$ 1000	986.8	1800	1776.2
2	.9608	100	96.1	100	96.1
3	.9356	100	93.6	100	93.6
4	.9110	100	91.1	100	91.1
5	.8870	100	88.7	100	88.7
6	.8637		100	86.4	
7	.8410			100	84.1
8	.8189			100	81.9

9	.7974			100	79.7
10	<u>.7764</u>			<u>100</u>	<u>77.6</u>
Total	8.8055	1400	1356.2	2700	2555.4
Model A UAC = $1356.2/4.6811 = \$289.7$					
Model B UAC = $2555.4/8.8055 = \$290.2$					

This example shows that the alternative of purchasing Model A has the best UAC. However, this does not necessarily mean that you should recommend this alternative. Other considerations must be taken into account, such as whether future price increases may favor the alternative with the longer economic life; whether major technological advancement in the near future would favor the alternative with the shorter economic life; and whether program requirements are likely to change in the near future, in which case the alternative with the shorter economic life would be favored.

1.8. Sensitivity Analysis. Sensitivity analysis identifies key assumptions and variables within an EA and determines how changes affect the ranking of alternatives. Its value lies in the additional information and understanding it brings to bear on the decision. For decision makers facing an investment decision, sensitivity analysis is a tool for determining how changes in costs or benefits (e.g., due to forecast errors) affect the EA's recommendation.

1.8.1. Sensitivity refers to the relative magnitude of the change in the results of an EA based on changes of one or more of the input variables. A decision is *insensitive* to uncertainties regarding a variable if you can change that variable over a wide range without affecting the ranking of alternatives. A sensitivity analysis demonstrates the stability (or instability) of the recommendation.

1.8.2. A major limitation of sensitivity analysis is that it only analyzes the assumptions, alternatives, or variables you have considered. This limitation emphasizes that critical thinking and dialog with experts is crucial to preparing a quality EA.

1.8.3. A primary reason for undertaking a sensitivity analysis on cost or benefit estimates is to deal with the uncertainty related to their derivation. The definition of uncertainty used here includes both risky and problematic situations. In a risky situation, the analyst knows the probability distribution relating alternative outcomes (i.e., all possible outcomes along with the probability of occurrence of each outcome are known). In an uncertain situation, the probability distribution cannot be determined. When anyone tries to estimate costs or predict future occurrences over a long time, variations are bound to occur between the estimated and the actual occurrences. Some variations in estimates can be described statistically, others cannot. For instance, consider the case of a life-cycle cost analysis of operating a vehicle fleet. Regardless of the estimating technique employed, any forecast of fuel costs will be subject to estimating error for fuel usage rates and uncertainty as to fuel prices. The Air Force Risk Methodology Handbook, available from SAF/FMCE, has a more thorough discussion of risk and uncertainty.

1.8.4. Conduct sensitivity analysis on:

- Variables, parameters, or assumptions that are both major cost drivers and sources of uncertainty.
- The discount rate (see paragraph 1.6.1).

Determine major cost drivers by calculating the percentage of total cost accounted for by each cost element. Use discounted costs. After determining the percentages of, for example, research and

development, investment, and recurring costs to the total for each alternative, then examine the major contributing variables in each of these areas.

1.9. Documentation Requirements. EAs must be thoroughly documented. Consult AFI 65-501, paragraph 1.7. To facilitate documentation, attachment 8 contains suggested formats. You may modify these formats to fit circumstances unique to a particular analysis. We strongly recommend that you submit a Format A for each feasible, costed alternative. We also strongly recommend submitting one Format A-1 showing the differential cost between the recommended alternative and the status quo or upgraded base-line alternative. The Format A-1 in attachment 8 only shows recurring costs. However, if a proposal requires periodic investment costs, you may modify the format to include such periodic costs. Formats B, C and C-1 may be used at the discretion of the analyst. We also recommend Format D, showing the final ranking of alternatives.

Chapter 2

PROGRAM EVALUATION

2.1. Actual Performance Versus Stated Programs. AFI 65-501, paragraph 2.12, defines program evaluation (PE), and requirements and responsibilities for PE.

2.2. General Program Evaluation Procedures. When preparing a PE:

2.2.1. Set reference points (baselines, milestones, and goals) for the analysis as soon as possible.

2.2.2. Determine if an EA supporting previous decisions is available. Previous EAs may help start the process of analyzing the program or operation's goals, assumptions, alternatives, costs and benefits, outputs, or effectiveness. However, avoid excessive reliance on a previous EA when the situation or contributing variables have changed.

2.2.3. Identify performance measures from the program or operation. It may be helpful to compare performance measures with related on-going programs.

2.2.4. Performance measures are inherently quantitative. If adequate data does not exist for measuring performance, work with experts to determine adequate measures and begin accumulating such data. The data must be auditable and reflect significant organizational missions and functions, satisfaction of customer needs, timely accomplishment of processes, relevant environmental impacts, or resources consumed or required. A good source of information to compare the operation, management and productivity of activities is unit cost resourcing (UCR) data, which are based on output measures and often require little modification for use in program evaluation.

2.2.5. Identify and discuss important non-quantifiable benefits, e.g., improvements in process quality, mission fulfillment, health, safety, morale or security factors.

2.2.6. Whenever trends are significantly different from previous estimates, examine specific reasons for the variance.

2.3. Methodology. The following step-by-step procedure can be used to facilitate output measurement problems.

2.3.1. Step I - Identify All Relevant Outputs. (Outputs may have already been identified by previous unit cost resourcing criteria.) Government programs/projects have at least one and often two or more objectives. These objectives may be prescribed by law, established by policy or may be based on historical practice. There should be a causative relationship between activity, as measured by the output indicator, and the resources consumed (costs). A restatement of resources consumed is not a good way to measure output. For example, a statement of the man-hours required to do a job is simply another way of accounting for resources consumed and tells little about what is accomplished. The difference between costs of competing alternatives, i.e., differential costs or costs savings, is not an "output" for purposes of program evaluation.

2.3.2. Step II - Establish Data Sources. Avoid generating unnecessary work by determining if adequate information is already available in some form (e.g., unit cost resourcing data or Defense Business Operations Fund data). Consider sources such as: established reports, opinions and judgments of experts, observations and tabulations of steps in work process, outside organizations and information centers.

2.3.3. Step III - Collect, Summarize, Evaluate, Validate and Display or Present Output Data.

Select a technique for summarizing the data in a tabular, graphic or other format as appropriate. Use your own discretion in deciding the method employed and techniques.

2.3.4. Step IV - Compare Output Data With Resources Consumed. In the analysis, identify the output and costs associated with a particular alternative or activity. If practicable, construct graphic relationships of output to cost to observe trends developing or to detect evidence of possible substandard performance. When output data are not quantifiable, the analysis is more difficult. In such cases, identify project outputs in precise terms and compare the outputs to the required resources so that the decision maker can determine the most reasonable course of action.

Chapter 3

SPECIAL ANALYSES

3.1. Lease-Purchase Decisions. The cost to the Treasury of special tax benefits, if any, associated with a lease should be added to the cost of the lease. Examples of such tax benefits might include:

- Highly accelerated depreciation allowances.
- Tax-free financing.

Consider current tax laws applicable to a lessor to determine whether or not an adjustment is appropriate in a particular EA. Since tax laws change, consult legal and contracting staff. If it is determined that a particular leased asset enables a lessor to take advantage of accelerated depreciation tax benefits, increase the contract bid to offset these losses to the Treasury. In most accelerated depreciation schedules, the amount of the special tax advantage is only the portion of the total allowance for depreciation which is in excess of "normal" economic depreciation, with the latter estimated as an annual amount equaling acquisition price divided by economic life, for each year of an asset's economic life. Attachment 11 contains additional information on lease-purchase procedures. Attachment 12 discusses analysis of special tax advantages in lease-purchase analysis.

NOTE:

Do not consider special tax benefits when analyzing energy projects.

3.2. Commercial Activities (A-76) Cost Comparisons. These cost comparisons are conducted in accordance with OMB Circular (OMBC) A-76, *Performance of Commercial Activities*. Air Force implementing guidance, AFI 38-203 and AFMAN 38-209 require:

- An informal cost-benefit analysis for all cost comparisons to determine if providing government property to a contractor is in the best interest of the government. Attachment 13 provides guidance on this analysis.
- For large cost comparisons (with greater than or equal to 75 full-time equivalents involved in the activity prior to undergoing cost comparison), an analysis of the impact of the cost comparison on the local economy. Attachment 14 provides guidance on this analysis.

3.3. Major Weapon System Warranty Cost-Benefit Analysis. AFMAN 64-110, *Manual for Weapon System Warranties*, governs Air Force policy on major weapon warranties. AFI 65-501 provides instruction on doing cost-benefit analysis on warranties. A certificate of satisfactory warranty cost-benefit analysis is at attachment 15. Attachment 16 is a request for waiver of warranty cost-benefit analysis.

3.4. Economic Analyses (EA) of Overseas Activities. An EA should provide an accurate estimate of the life cycle cost (LCC) of each alternative under consideration, expressed in present value terms and denominated in US dollars. When an activity involves settlements in foreign currency or settlements indexed to foreign economic indicators, express these settlements in US dollars. There are generally two types of foreign currency settlements; transactions in:

- Convertible currencies.
- Nonconvertible currencies.

The exchange rates between the US dollar and convertible currencies vary with market conditions, while the exchange rates between the dollar and nonconvertible currencies are administratively established. Generally countries with US bases have convertible currencies.

- For convertible currencies, see attachment 17 for more information on conversions.
- For non-convertible currencies, use official exchange rates.

3.5. Marginal Analysis. Marginal analysis assists a decision-maker to allocate limited resources between competing projects. A decision-maker may possess economic analyses or other documents that can partially aid in solving this allocation problem. However, a financial analyst may need to further examine the data in these documents to provide a more insightful comparison between projects for the decision-maker. If a financial analyst only provides cost-benefit ratios for a decision-maker to select alternatives, he or she may ignore the total life cycle cost to the Air Force. Conversely, relying solely on total costs to pick solutions ignores the benefits accrued from each alternative. These particular analytical tools provide methods to compare alternatives within a single project. A decision-maker may require more information to select the proper alternatives for individual projects given many competing projects and a limited budget.

3.5.1. Marginal analysis attempts to bridge this gap. This type of analysis compares the marginal or incremental cost and benefits derived from one alternative to the next most expensive alternative within a project. This method allows the decision-maker to compare alternatives on several projects on a common footing, cost and benefits. The analysis provides a decision-maker with information to evaluate how much more the next alternative will cost and what future benefits it provides. The decision-maker can compare how much an alternative of one project compares to another alternative of another project. This type of analysis is extremely useful for making comparisons between projects.

3.5.2. An example of marginal analysis is at attachment 18.

3.6. Preliminary EAs. AFI 65-501, paragraph 2.2.5, gives instructions on preliminary EAs for engineering projects. A format for preliminary EAs is at attachment 19.

3.7. Military Construction (MILCON) Design Phase EAs. By a tri-service agreement, EAs for the design phase of MILCON follow special procedures. See attachment 20.

3.7. Internal Rate of Return. EAs supporting Productivity Investment Fund (PIF) and Component Sponsored Investment Program (CSIP) projects require an internal rate of return (IRR) calculation. Consult attachment 21 for IRR procedures.

3.8. Business Process Improvement and Functional Economic Analysis. Functional Economic Analysis (FEA) is a special type of EA supporting business process improvement (BPI) analysis (also called business reengineering or functional process improvement). FEAs follow special procedures and often support acquisition of automated information systems. BPI analysis attempts to simplify the business process before it is computerized. The goals of BPI are to increase effectiveness, reduce costs and streamline organization. Technology is applied only after the optimal business process is defined and implementation has begun. Attachment 22 contains additional information on BPI and FEAs.

Chapter 4
ECONOMIC IMPACT

4.1. Basic Concepts. This chapter specifies procedures and provides a format for calculating economic impact (EI). The EI consists of unclassified information describing the economic effect of an installation/activity in its Economic Impact Region (EIR), the area within a 50-mile radius of an installation or activity. Estimating EI of installations is not an Air Force requirement. The principles provided here may assist analysts if commanders request analysis of economic impact.

4.1.1. An EI estimates the number of secondary jobs outside of the installation/activity that are created hypothetically from base expenditures in the EIR. This estimate of secondary jobs is a basis from which to begin an assessment of local jobs impacted by realignment and closure actions.

4.1.2. Data Collection. Data collection is the most difficult and time-consuming task of determining the EI of an installation/activity. If the data collection effort has been well organized, the calculation of the EI will only require a small share of the total effort. To organize the data collection effort,

- Consolidate EI data requirements by the office of primary responsibility (OPR) to avoid multiple requests to the same source. (See figure 4.1 for a list of data sources.)
- Reconcile any conflicting numbers.
- Annualize all expenditures for construction, contracts, payroll, and other procurements that are spent over more than one fiscal year. If actual expenditures are not available, distribute the contract amount for a project or service evenly over the number of years of the contract. If actual expenditures are available, use only the actual expenditures during the reporting period in the EI calculation, not the contract value.

Figure 4.1. EI Data Sources.

Primary Source	Variable	Secondary Source
Base Financial Services Office	O&M Expenditures Civil Service Payroll	AFI 65-503
DFAS-DE/FJ Lowry AFB, CO DSN 926-6059	Military Payroll	AFI 65-503
DoD Office of the Actuary 1600 N. Wilson Blvd. Arlington, VA 22209 DSN 226-5869/5864	Military Retired Pay	

Primary Source	Variable	Secondary Source
US Coast Guard 444 S.E. Quincy St. Topeka, KS 66683-3591 (913) 295-2538	Retired Pay (USCG)	
Base Contracting	O&M Construction Procurement Contracts	
	Number of Contractor Civilians (FTEs)	Contact OPR requiring the contract
	NAF Construction	Base Civil Engineers, NAFFMO
	MFH Construction	Base Civil Engineers
Dept. of Education 400 Maryland Ave., N.E. Washington DC 20002 (202) 732-5138	Education Impact Aid Funds	Local School District
OCHAMPUS/IS Aurora, CO 88045 (303) 361-8627/3111	CHAMPUS Funds	
Retail Facility (Activity Manager)	BX Payrolls	
	Local BX, Commissary Procurement	
NAF Financial Management	NAF Payrolls	

Primary Source	Variable	Secondary Source
Base Education	Tuition Assistance	
Corps of Engineers	Large MILCON Expenditures	Base Civil Engineer
	Special Project Expenditures	Project Managers at base or command level
Billeting (MWRS)	Off-Base TDY Nights	
Base Personnel (MPF)	Number of AF Personnel, Military and Civilian	
	Residence of Military Personnel	
Unit Administration	Number of ANG/AFRES	
Tenant Accounting	Tenant Payrolls	AFI 65-503
Training Institution	Trainee Payrolls	AFI 65-503

4.1.2.1. The EI calculation should be limited to payroll and procurement expenditures in the local EIR. When calculating the EI in the EIR, include expenditures to contractors outside the EIR only if the contract involves the use of locally supplied goods and services, and labor performed in the EIR.

4.1.2.2. In cases where accurate data for projects and activities are not available, approximations or expert judgment may be used. Based on historical experience, knowledgeable estimates by the analyst or an office specialist may be used.

4.2. Personnel. Table 4.1 displays a format for listing personnel by resident location. Personnel listed in this section should include all personnel employed by the installation/activity, regardless of where their servicing personnel or payroll office is located. Military retirees, dependents, and traditional guardsmen/reserve personnel who are also civilian employees should be counted in each category, as applicable.

4.2.1. For military personnel, indicate the number of active duty personnel assigned by type (permanent-party and trainee/cadet) residing on and off the installation. Show non-extended active duty guardsmen/reserve personnel separately.

4.2.2. For civilians, report the number of personnel by category: general schedule, federal wage board, and other groupings. Break down NAF, contract civilian, and private business categories as illustrated in table 4.1. Report the number of full-time equivalent (FTE) contract civilians assigned if

applicable. The number of FTEs is in essence a measure of the contractor's workforce somewhat analogous to FTEs defined in A-76 Commercial Activities. The number of FTEs should be available from the contracting office. The information may also be obtained from the functional organization requiring the contract. Lastly, if this data is not readily available, an approximation can be determined by dividing the total labor cost by cost per manyear or total labor hours divided by hours per manyear.

4.3. Payroll. Table 4.2 includes the summary of gross payroll. Payroll is defined as gross income including basic pay, benefits, and allowances. Do not include in payroll the retirement funds accrued and employer contributions that are not immediately available to the employee. All data requests for civilian and military appropriated fund payroll should request net pay (i.e., after taxes, employer contributions, etc.).

4.3.1. Military pay is the gross income (including flight pay, etc.) actually paid to the member. It does not include retirement accrual or social security contributions made by the US Government.

4.3.2. In table 4.2, appropriated fund civilians are reported by General Schedule (GS), Wage Board (WB), and other. Report payroll for civilian NAF/BX and employees of private sector businesses located on base. Under certain circumstances, report payroll of contract civilians not elsewhere included (n.e.i.).

4.3.2.1. To avoid double counting, care must be exercised in reporting payroll in the contract civilians, n.e.i., category. If the payroll of contract civilians is part of a contract amount reported under contracts and procurement category of table 4.3, do not enter the payroll amount in this section. Also, do not breakout civilian payroll from contracts to enter in the civilian, n.e.i., category. The labor component of contracts is estimated later in the EI calculation.

4.3.2.2. If the contract civilian payroll is not included in contract amounts in table 4.3, enter the payroll amount as contract civilian, n.e.i.

4.3.3. For trainees and cadets, payrolls should be obtained from the training institutions. The head count and composite rate method is a second source for trainee payroll data. Records of payrolls for ANG/Reservists are kept by the budget officer at the local unit office. Include the payrolls for non-extended active duty guardsmen and reserves within the EIR.

4.3.4. Civil Service payrolls can be requested directly from the accounts control office or, if necessary, estimated by multiplying the number of civilian employees, GS and WB, by the appropriate civilian standard composite pay rate by command from AFI 65-503. The composite pay rate must be multiplied by 0.893 to calculate payroll net of retirement accrual and other employer sponsored contributions.

4.3.5. NAF payroll data are available from the base NAF Financial Management Branch (NAFFMB). Employees of retail facilities on the installation are paid directly by the proprietors. The manager of the specific activity should be contacted directly for payroll information. Similarly, payroll figures for base exchange employees can be obtained from the base exchange manager. Do not include in payrolls the retirement funds accrued and employer contributions that are not immediately available to the employee.

4.4. Local Contracts. Contracts for supplies and services are major contributors to an EI. A local contract is an expenditure of funds for labor and supplies provided from within the EIR by contractors. The place of performance determines a local or non-local contractor. The nature of the impact on the local

economy depends largely on the type of contract. Construction expenditures and contracts for services have a larger labor component and thus a greater direct local revenue impact than expenditures for supplies and materials, in which much of the revenues are quickly passed out of the area through local wholesalers. Contract expenditures should be broken down in considerable detail to accurately estimate local impact.

4.4.1. A summary of construction, contracts, and other procurements is provided in table 4.3.

- NAF construction expenditures are for the construction and maintenance of NAF facilities, and are funded from the proceeds of NAF activities.
- Military family housing (MFH) construction usually includes projects to build, repair, renovate, or upgrade on-base family housing.
- Operations and maintenance (O&M) should include only those costs associated with contract construction (i.e., minor construction, architectural and design fees, and real property maintenance contracts).
- Other construction should include those projects which do not clearly fit into one of the previous construction categories.

4.4.2. Contract expenditures other than construction reported in table 4.3 should be divided into service and nonservice categories, an important distinction since service industries tend to have a greater local EI than do industries involving the purchases of supplies and equipment. The service and non-service procurements reported in table 4.3 are used in the "Direct Payroll Impact and Direct Materials and Supplies" calculations.

4.4.3. Local purchases of goods and services by the commissary/ base exchange have a direct economic impact on the EIR. Normally, firms within the EIR supply local products and act as distributors to the commissary/base exchange for goods produced outside the region. Alternatively, non-local firms may subcontract with the commissary for local goods provided by a local distributor. These arrangements usually involve payments to local firms.

4.4.4. CHAMPUS allows military retirees and dependents of active-duty and retired personnel to use civilian medical care when required services are not available from military facilities, or when travel to the nearest medical facility places undue hardship on the patient. CHAMPUS expenditures correspond to a 40-mile radius around the hospital, and not necessarily to the boundaries of the EIR. Include only active duty dependent CHAMPUS cost in the economic impact calculation. An allocation should be used if there is more than one military installation in the area (e.g., based on Air Force active-duty strength).

4.4.5. Local school districts receive education impact aid funds (Public Law 81-84) as reimbursement for educating base federal employee's dependents living on or off the federal installations. Contact the U.S. Department of Education for this information (see figure 4.1 for address). An allocation should be used if there is more than one military installation in the EIR (e.g., based on military and civilian personnel assigned to the installation). Tuition assistance data can be obtained from the base education office.

4.4.6. Military and civilian personnel on temporary duty (TDY) are often assigned to civilian quarters off base. Temporary billeting in local motels and meals purchased from local restaurants may amount to a substantial impact on the local economy, especially for areas with a high volume of military and civilian visitor traffic. Off-base TDY expenditures are estimated by multiplying the number of

off-base TDY nights (overnight stays for which on-base quarters were not available) times the average per diem in the local area. The number of off-base TDY nights should be available from the billeting office.

4.4.7. The person responsible for accurately estimating construction expenditures must be able to obtain consistent information from a variety of sources. While there are no standardized reporting documents, there are three common sources for construction expenditures:

- The local contract office (contracting officer) should have information on NAF, O&M construction, Military Family Housing (MFH), and Military Construction Program (MCP) projects.
- The local Corps of Engineers Office accounts for many construction projects within its jurisdiction.
- Your local civil engineer will have a project number and description for all new construction. Many engineers produce a contract status or management report. This report will typically include the dollar amount, percentage completed, contractor name, and date of the contract award.

4.4.8. Procurements are monitored through the contracting office. Distinguishing service contracts from the overall number of contracts is sometimes troublesome. There are a variety of approaches for obtaining the number and value of service contracts.

- The number may be available from the contracting office. Service contracts can be identified either by in-house programming codes or by cross-referencing existing contracts with a list of DoD service contract titles, as summarized in DoDM 4105.61M.
- The analyst can use whatever breakdown of procurements is available from a routinely prepared report and, referring to the list of service contracts from DoDM 4100-33, identify service contracts from the available groupings.
- When services cannot be systematically distinguished from other procurements, the analyst may rely on contracting office estimates.

4.4.9. If contracts for the operation of the installation/activity cannot be broken down by type, as shown in table 4.3, the analyst may choose to report only the total for each category.

4.5. Economic Impact Region. A local EI is limited to a geographic area. Equipment purchases made from another region or state, for instance, are not considered part of the of the local impact. The EIR should consist of those counties within a 50-mile radius of the installation/activity. In some cases natural barriers or other factors may result in a smaller EIR than represented by the counties within the 50-mile radius.

Table 4.1. Summary of Personnel By Classification and Housing Location.

-- As of 30 September 19XX --

Classification	Living	Living	Total
	On Base	Off Base	

APPROPRIATED FUND MILITARY

-- As of 30 September 19XX --

Classification	Living On Base	Living Off Base	Total
Active-Duty	2,800	3,400	6,200
ANG/Reserve	2	15	17
Trainees/Cadets	76	0	76
Non-extended Active Duty Guardsmen/Reserve	0	141	141
TOTAL	2,878	3,556	6,434
ACTIVE DUTY MILITARY DEPENDENTS	4,200	5,600	9,800
APPROPRIATED FUND CIVILIAN			
General Schedule			532
Federal Wage Board			373
Other			268
TOTAL			1,173
NONAPPROPRIATED FUND, CONTRACT CIVILIAN, AND PRIVATE BUSINESS			
Civilian NAF			370
Civilian BX			440
Contract Civilians, n.e.i.*			25
Private Businesses on-base by type:			
Branch Banks/Credit Union			35
Other Civilians, n.e.i.*			20

*Not elsewhere included.

Table 4.2. Summary of Annual Gross Payroll by Classification and Housing Location.

Classification	Fiscal Year 19XX		Total
	Living On Base (\$)	Living On Base (\$)	
APPROPRIATED FUND MILITARY			
Active Duty	\$52,000,000	\$113,500,000	\$165,500,000
ANG/Reserve	56,490	470,364	526,854
Trainees/Cadets	1,500,000	0	1,500,000
Non-extended Active Duty Guardsmen/Reserve	0	1,240,000	1,240,000

Classification	Fiscal Year 19XX		Total
	Living On Base (\$)	Living On Base (\$)	
TOTAL	\$53,556,490	\$115,210,364	\$168,766,854
APPROPRIATED FUND CIVILIAN			
General Schedule			16,162,000
Federal Wage Board			33,900,000
Other			500,000
TOTAL			50,562,000
NONAPPROPRIATED FUND, CON- TRACT CIVILIAN, AND PRIVATE BUSINESS			
Civilian NAF			\$4,500,000
Civilian BX			6,700,000
Contract Civilians, n.e.i.*			0
Private Businesses on-base by type:			
Branch Banks/Credit Union			640,000
Other Civilians, n.e.i.*			100,000
TOTAL			\$11,940,000

*Not elsewhere included.

Table 4.3. Summary of Construction, Contracts, and Expenditures for Materials, Equipment, and Supplies.1

-- Fiscal Year 19XX --	
	Actual Annual Expenditure
CONSTRUCTION	
Military Construction Program	\$20,127,411
Nonappropriated Fund	149,756
Military Family Housing	977,626
O&M	4,000,000
Other	98,300
TOTAL CONSTRUCTION	\$25,353,093

CONTRACTS AND PROCUREMENT: SERVICES, MATERIALS, EQUIPMENT,
AND SUPPLIES

Services Contracts ²	\$67,310,536
Other Services, n.e.i. ³	0
Total Services	\$67,310,536

Commissary, Base Exchange, Health, Education and TDY

Expenditures

Commissary	\$7,000,000
Base Exchange	5,000,000
Health (CHAMPUS, Government Cost Only)	12,000,000
Education (Impact Aid and Tuition Assistance)	3,500,000
TDY	4,000,000
Other Materials, Equipment and Supplies Procurement, n.e.i. ³	\$25,000,000

TOTAL EXPENDITURES	149,163,629
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NOTES:

1. Does not include contracts for services supplied to other Air Force installations.
2. Includes only contracts in EIR or contracts requiring the use of locally supplied goods and services.
3. Not elsewhere included.

Chapter 5**ANNUAL ECONOMIC ANALYSIS REPORT****5.1. Annual Economic Analysis Report (RCS: HAF-FMC [A] 9501):**

5.1.1. Each MAJCOM, DRU, FOA, and similar Air Force organization will prepare and forward a copy of an annual report concerning their economic analysis program to SAF/FMCE. This report will provide information on the number, type, revisions, and other information concerning their economic analyses. Organizations will forward their report to SAF/FMCE NLT 1 December and cover the previous fiscal year. See attachment 23 for format.

ROBERT F. HALE

The Assistant Secretary of the Air Force for Financial
Management and Comptroller

Attachment 1

GLOSSARY OF TERMS

Terms

Alternativ—An approach or program that is another possible way of fulfilling an objective, mission, or requirement. The status quo, or an upgrade to the status quo, is usually an alternative to a proposed course of action.

Benefits—Objective measures of an alternative's value to the United States. When a dollar value cannot be placed on comparable program or project benefits, other objective measures may be available and useful for comparing alternatives. Monetary benefits are receipts of the United States due, e.g., to sale of physical assets, or reductions in costs of other programs due to the action of the program under analysis.

Benefits Analysis—Analysis to identify, measure and evaluate the benefits for each proposed alternative.

Commercial or Industrial Activities—Activities that provide products or services obtainable (or obtained) from a commercial source. Commercial activities are operated by Air Force military or civilian personnel, or by contractor personnel.

Constant Dollar Value or Costs or Benefits—Value, cost, or benefits measured based on constant purchasing power of the dollar. That is, constant dollar analyses are done from the perspective of a constant general price level, though relative prices may vary.

Constraints—Limitations of any kind to be considered in planning, programming, scheduling, implementing or evaluating programs.

Cost-Benefit Analysis or Cost-Effectiveness Analysis—See Economic Analysis.

Cost-Effective Alternative—That alternative, which, when compared to all other alternatives: a) Maximizes benefits when costs for each alternative are equal, or b) Minimizes costs when benefits are equal for each alternative.

Current Dollar Value or Costs or Benefits—Value, cost, or benefit measures which include estimates of all expected future price changes. In current dollar analyses prices, costs, and other dollar-denominated measures are increased based both on anticipated year-to-year changes in the general price level and on anticipated changes in relative prices.

Discount Rate—The parameter used to translate future costs or benefits into present worth (see "Present Value" below). It is a measure of the time value of money.

Discounting—The process of using the discount rate to determine the present value of costs and benefits. (Elements of cost and benefit streams are multiplied by their corresponding discount factors to yield discounted costs and benefits.)

Economic Analysis—A systematic approach to the problem of choosing how to use scarce resources. It reveals the present value of the monetary costs and benefits associated with all alternatives under consideration, and provides as accurate and complete a picture as possible of nonmonetary costs and benefits.

Economic Life—The period of time over which the benefits to be gained from a project may reasonably be expected to accrue to the DOD. It is the shortest of physical, technological or mission life.

Effectiveness—Ability of a project to meet objectives.

Efficiency—The amount of output per unit of input. Alternatively, it is the quality whereby one alternative uses less input per unit of output than other alternatives.

Expected Annual Cost—The expected annual dollar value of resources, goods, and services required to establish and carry out a program or project.

Feasibility Study—A study of the applicability or practicability of a proposed action or plan.

Historical Cost—The cost of any item, based on actual dollar (or equivalent) outlay, ascertained after the fact.

Imputed Value—The value assigned to actions or transactions that are not explicitly priced (e.g., transfers of assets between government programs). Estimates of the dollar value of imputed costs can be obtained from estimating the undepreciated (i.e., remaining) value of assets, if those assets have an alternate use.

Induced Costs—Those costs that execution of a given project or program alternative impose on another Air force or government program. For example, if a proposal to move an activity into facilities currently occupied by a second activity causes expenditures by the second activity for real property acquisition or improvement, then those expenditures are induced costs that should be taken into account in the decision to move the first activity.

Investment Costs—Those program costs required beyond the development phase to introduce into operational use a new capability; to procure initial, additional, or replacement equipment for operational forces; or to provide for major modifications of an existing capability. They exclude research, development, test and evaluation, military personnel, and operation and maintenance appropriation costs.

Life-Cycle Cost—The total cost to the government for a system over its full life, including the cost of development, procurement, operation, support, and disposal.

Mission Life—The time period of program use or operation.

Objective Statement—A statement of what is ultimately to be accomplished. In economic analysis objectives are stated such that there is no bias toward a particular alternative.

Opportunity Cost—The cost of a resource, measured in terms of its value in the highest alternate use.

Output—Goods and services produced or mission accomplished.

Physical Life—The estimated time that a machine, piece of equipment, or building can be used in the function for which it was procured or constructed. An initial estimate of physical life may require adjustment if significant alterations or conversions are subsequently proposed or effected.

Present Value—The net value of a flow of funds, expressed as a single sum of dollars; effectively, the sum of money equivalent to all current and future flows. Calculated by multiplying the net cost figure for each year by the corresponding discount factor, and summing the results.

Program Evaluation—Analysis of ongoing actions to determine how well the stated objectives are being accomplished. Program evaluation studies entail a comparison of actual with intended performance.

Real Property—Land, buildings, structures, utility systems, improvements, and appurtenances thereto. Includes equipment attached to and made part of buildings and structures (such as heating systems) but not movable equipment (such as plant equipment).

Recurring Costs—Expenses for personnel, material consumed in use, overhead support services, and other items incurred on a repeating basis.

Residual Value—The expected value of an asset at any point in time before the end of its economic life.

Risk—The likelihood that some assumption or estimate is wrong. Sometimes used synonymously with "uncertainty," though uncertainty can be described by a probability distribution.

Sensitivity Analysis—Examination of the effects obtained by changing the direction and magnitude of assumptions embodied in an analysis or key variables or factors in an analysis.

Sunk Cost—The sum of past expenditures or irrevocably committed funds related to a project. Such costs are generally not relevant to decision making as they reflect previous rather than present choices.

Technological Life—The estimated number of years before technology will make the existing or proposed equipment or facilities obsolete.

Terminal Value—The expected value of assets at the end of their economic life.

Uniform Annual Cost—The average cost per year for a given alternative. It is calculated by dividing the total net present cost (for the full-time life cycle) by the sum of the discount factors of the years in which benefits accrue (economic life).

Attachment 2**REQUEST FOR WAIVER FROM AN ECONOMIC ANALYSIS**

An economic analysis was not prepared for this project for the following reasons:

____ a. Project cost or benefits to be derived do not warrant the level of effort required to prepare a full and complete analysis. The factors supporting this decision are attached.

____ b. There is only one method possible to accomplish the objective. Documentation of this condition is attached.

____ c. The project and the method to accomplish it was directed by _____ as shown in the attached documentation.

____ d. Project results from specially directed legislation which directs the method of accomplishment, as documented in the attachment.

____ e. The project corrects problems or violations involving health, safety, fire protection, pollution, or security which are serious, urgent and hazardous.

____ f. Other (List specific reasons why analysis was not prepared).

Coordination at base/installation level:

Base Level Financial Analysis:

(Signature)

(Name/Office Symbol/DSN/Date)

Concurrence by Base Functional Office:

(Signature)

(Name/Office Symbol/DSN/Date)

Concurrence by other Base Level Office:

(Signature)

(As Applicable)

(Name/Office Symbol/DSN/Date)

Concurrence by Base Level FM:

(Signature)

(Name/Office Symbol/DSN/Date)

Coordination at MAJCOM Levels:

MAJCOM Financial Analysis Office:

(Signature)

(Name/Office Symbol/DSN/Date)

MAJCOM Functional Office

(Signature)

(Name/Office Symbol/DSN/Date)

Other MAJCOM Office

(Signature)

(As Applicable)

(Name/Office Symbol/DSN/Date)

Attachment 3

EXECUTIVE SUMMARY FORMAT

Installation: e.g., Blue AFB, State (For Overseas: Country)

Project Title (if applicable, include project number)

Scope of Project: (quantify to extent possible)

Alternatives Considered: (briefly describe; for any dismissed as infeasible, briefly explain)

Discounted Life Cycle Costs of the Alternatives: (state discount rate used and whether constant or inflated dollars were used, for constant dollars, show year, e.g., constant 96\$)

Cost-Benefit Ratios (CBR): (if benefits were quantified, show CBR for each alternative)

Discussion of Benefits and Recommendation: (discuss benefits and costs of each alternative and reasons for recommended alternative)

Attachment 4**CERTIFICATE OF SATISFACTORY ECONOMIC ANALYSIS**

Installation/MAJCOM:_____

Project Title:_____

An economic analysis has been prepared for this project. The following alternatives have been considered:

- a.
- b.
- c.

Summary of analysis results:

Certification: This economic analysis follows the instructions in AFI 65-501, *Economic Analysis*, and the procedures in AFMAN 65-506,. Significant changes to project scope, major assumptions, or estimated costs will invalidate this certificate and require revision of this analysis.

Coordination at base/installation level:

Base Level Financial Analysis:

(Signature)

(Name/Office Symbol/DSN/Date)

Concurrence by Base Functional Office:

(Signature)

(Name/Office Symbol/DSN/Date)

Concurrence by other Base Level Office:

(Signature)

(As Applicable)

(Name/Office Symbol/DSN/Date)

Certification by Base Level FM:

(Signature)

(Name/Office Symbol/DSN/Date)

Coordination at MAJCOM Level:

MAJCOM Financial Analysis Office:

(Signature)

(Name/Office Symbol/DSN/Date)

MAJCOM Functional Office:

(Signature)

(Name/Office Symbol/DSN/Date)

1 JULY 1995

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Other MAJCOM Office:
(As Applicable)

(Signature)
(Name/Office Symbol/DSN/Date)

Attachment 5**ECONOMIC ANALYSIS CERTIFICATION CHECKLIST**

This attachment provides a reference and guide for those responsible for review and certification of economic analyses. All resource requirements in the Air Force compete for available resources. For priority ranking of competing requirements, consistency in evaluation and certification is necessary. This certification checklist is designed to achieve that purpose.

1. Objective or Problem Statement:

- a. Is the objective clear and specific?
- b. Is the objective realistic?
- c. Are any feasible alternative solutions excluded due to a bias in the objective statement?

2. Assumption for Constraint Development:

- a. Are all assumptions recognized and identified?
- b. Are the assumptions realistic and properly supported?
- c. Are assumptions used when obtainable facts are available?
- d. Are assumptions unnecessarily restrictive thereby preventing consideration of feasible alternatives?
- e. Do assumptions include economic life and future changes in operations requirements?

3. Alternative Identification:

- a. Are all feasible alternatives considered?
- b. Were alternatives rejected before a full analysis was adequately documented?
- c. Are the alternatives significantly different as opposed to superficial restructuring of a single course of action?
- d. If adequate, was the status quo used as the baseline for alternative evaluation?
- e. Were other government agencies' capability to provide a product or service included as an alternative?
- f. Were contracting alternatives considered?

4. Cost Analysis:

- a. Are all government direct and indirect costs included for each alternative?
- b. Do investment costs include transportation, installation, support, and training costs incurred before operational and building occupancy dates, etc.?
- c. Are personnel costs all inclusive; that is, specific skill levels, fringe benefits, overtime and shift differentials, etc.? Are personnel costs broken out by rank/grade, number of employees in each category, etc.?
- d. Are future equipment replacement costs included as investments as opposed to operations costs?

- e. Are available asset values considered and are such values adequately documented?
- f. Are cost collection and aggregation methods correct?
- g. Are estimating relationships and procedures identified and properly supported?
- h. Are program or project costs expressed in constant dollars?
- i. Where inflation or cost escalation is used, have the factors been identified and validated?
- j. Are cash flows discounted at the proper discount rate?
- k. Are cost and savings schedules realistic?

5. Benefit Analysis:

- a. Have all project results, outputs, benefits, or yields been included?
- b. Are the benefits identified in measurable terms where possible?
- c. Are benefit measuring techniques properly defined and supported?
- d. Is benefit priority or ranking criteria clearly stated and used in the evaluation? Is any weighting scale consistently and reasonably applied?
- e. Are negative results or outputs identified and adequately evaluated?
- f. Are secondary benefits (not related to the objective) identified?
- g. Do the benefits relate to the program and project objective?
- h. Are all cost savings represented as a negative cost rather than as a benefit?
- i. Are the benefits suitably tabulated, graphed, etc.?

6. Comparison Selection Evaluation:

- a. Were alternative selection criteria applied consistently?
- b. Are cost and benefit data suitably displayed to accurately depict relationships?
- c. Was a cost-benefit ratio calculated in support of the recommendation, and, if so, was it presented in the executive summary?
- d. Are the alternatives compared to a common baseline (minimum requirements level)?
- e. Were alternative comparison techniques suitable for the program project being evaluated; that is, present value, cost-benefit ratio, discounted payback period, uniform annual cost, etc.?
- f. Was a specific course of action recommended?
- g. Does analysis data clearly support the recommendation?
- h. Are significant differences between the recommended and other alternatives clearly identified?

7. Sensitivity Analysis:

- a. Were the effects of possible changes to the objective requirements evaluated?
- b. Would the recommended alternative remain the same if key assumptions or criteria were varied within a feasible range?

c. Was the program project schedule evaluated for both operational and cost impacts (slippages, advancements)?

8. Executive Summary:

a. Does the executive summary adequately state the problem, study objective, and significant criteria, assumptions and constraints?

b. Are the feasible alternatives clearly identified and differences explained?

c. Is the recommended alternative adequately supported without reference to detail study content?

9. Subordinate Command Certification:

a. Are comptroller program or project OPR certifications attached?

b. Are unresolved analysis issues properly documented by both the Comptroller and project OPR?

Attachment 6

SAMPLE

NONCONCURRENCE WITH AN ECONOMIC ANALYSIS

Reply to:

Subject: Nonconcurrence with an Economic Analysis (Title or Subject of the Analysis)

To:

1. My staff has reviewed the subject economic analysis according to the requirements and criteria of AFI 65-501 and AFMAN 65-506. During that review certain discrepancies were noted which preclude certifying the analysis as a reasonably complete and objective economic justification of the recommended alternative.
2. As our staffs have not been able to reconcile these discrepancies, I am required to notify you formally that we are not able to certify the economic analysis and to request your personal review of the issues and questions involved.
3. The following comments relate to specific issues that have not been adequately addressed:

(Signed by Certifying Official)

Attachment 7

ECONOMIC ANALYSIS PREPARER'S GUIDE

In this attachment each of the specific steps in the economic analysis process is amplified in the form of questions and accompanying rationale. This guide may be used to prepare the analysis, as a checklist to evaluate the completeness of the final product, or by reviewers.

1. Statement of the Problem:

a. Is the Stated Problem the Real Problem? Critical to the successful completion of the economic analysis is the identification and clear statement of the right problem. Often symptoms and not the disease are believed to be the problem. Seeking solutions to the wrong problem, or a poorly stated problem, almost always leads to the wrong solution because of missed alternatives, faulty assumptions, etc.

b. Does the Analysis Fully Address All Significant Pieces of the Problem? The analyst must fully identify and consider all facets of the problem. Watch for significant problem components either not identified or not fully treated in the study. Impacts (both costs and benefits) on tactical units, tenants, and satellite activities serviced by the installation should be addressed.

2. Assumptions:

a. Are All Assumptions Identified? Watch for assumptions that are not identified since assumptions imply a limitation or a judgment. Assessing the impact of limitations and the validity of judgments contained in all assumptions is necessary. A common assumption, seldom made explicit, is that a given organization or system operates by itself. Such an assumption can contribute to inadequate consideration of support provided and complementary outputs produced by related systems. This can lead to improper measurement of total costs and benefits and erroneous conclusions and recommendations.

b. Are the Assumptions Unduly Restrictive? Assumptions, when properly used, narrow the scope of an economic analysis to manageable proportions. However, the assumptions should not unduly restrict the study by eliminating possible significant alternatives or by narrowing the scope of consideration. This examination should be made throughout the review of the analysis and not only during the initial review of the stated assumptions.

c. Do Any of the Major Assumptions Incorrectly Treat Measurable Uncertainties as Facts?

(1) Uncertainty can be defined as the lack of reliable knowledge for assigning values or probabilities to factors influencing decisions. Uncertainties can be quantified or qualified. Examples of measurable uncertainties are projected workloads, personnel retention rates, equipment usage, and availability and reliability rates.

(2) The analyst should be alert to major assumptions, either stated or implied, assigning fixed values to variables subject to uncertainty--the assigned values then being treated in the analysis as facts. An example of this type of shortcoming is the assumption that a proposed supply or maintenance system will encounter a constant annual workload. This workload would often be based on the experience of the prior year, with adjustments made for certain variations.

(3) Assessment of uncertainty in workloads and other crucial variables should be examined. The number of sensitivity analyses required and feasible is a matter of judgment. Limits to the time

and manpower available for a given study exist. Sometimes, an educated guess, considering all the circumstances, will suffice.

(4) In effect, the preparer must judge when the study includes adequate sensitivity analyses in light of the time and resources allotted to the study, the magnitude of the proposed investment, and the likelihood additional analyses would significantly affect the study results.

d. Do Any of the Major Assumptions Treat Qualitative Uncertainties As Facts?

(1) Major qualitative uncertainties treated as assumptions also tend to dictate results. The availability of community services, military standardization policies, and advances in the state-of-the-art that lead to new equipment capabilities are examples of qualitative uncertainties. Other qualitative uncertainties that may be present in analysis, whether presented as such or not, are ones related to political considerations. Examples are availability of base rights, assurance of oversight permission, and the character of future environmental standards.

(2) Treatment of these kinds of uncertainties is not easy. A good analysis will address the major types of uncertainty directly and try to show how different assumptions have an impact on the study result. A study of alternative waste disposal systems thus might investigate the effects of increasingly severe environmental standards and the possible use of improved filtration processes.

(3) One method of coping with qualitative uncertainties is to use contingency analysis. This involves repetitive analysis with different qualitative assumptions to determine how changes in these assumptions change the results of the first analysis. The amount of contingency analysis, like the amount of sensitivity analysis, that should be undertaken in the end reduces to a matter of judgment. Remember, however, contingency analysis can entail significantly more work for the analyst.

e. Are the Major Assumptions Reasonable? Major assumptions must be examined to determine if they are reasonable. This is easier if the analysis documentation explains why each assumption was made. A useful technique is to try to make other plausible major assumptions. If these invalidate the study results, then the analysis is questionable.

3. Are All Feasible Alternatives Included?

a. Are Current Capabilities or the "Base Case" Adequately Considered?

(1) Current capabilities must not be omitted from consideration in constructing alternatives except for clearly stated valid reasons. Valid reasons may include inability of the current system to accomplish the current or proposed objective. Current capabilities, where proper, also must be considered as part of a proposed alternative.

(2) If the current system is to be used in an analysis, it should be used as a base case and should concentrate on the differences in benefits and costs expected to result from the adoption of one or more of the proposed alternatives. This is proper provided the base case is a feasible alternative; that is, capable of attaining the proposed objectives.

b. Are All Possible Significant Interfaces With Existing Systems or Projects Adequately Considered in Designing the Alternatives? Proper treatment of alternatives requires careful examination of how the proposed alternatives affect and are affected by related system or projects. The need for this examination is crucial in areas such as transportation and management information systems.

c. Are Combinations of Systems or Projects Considered Among the Alternatives? Watch for failure to consider viable alternatives based on mixtures of two or more efforts that combine the best features of each. For example, in a management information analysis, one alternative might be a manual system. Another might be a combination of a manual and an automated system.

d. Are There Feasible Alternatives That Have Been Omitted? If any of the answers to the previous questions on "Alternatives" are negative, it is possible some feasible alternatives were not included. However, there are practical limits on the time and manpower available for a given analysis. The relative importance of the subject under study will also influence the number of alternatives examined.

4. Cost Analysis:

a. Are Cost Models Identified? A cost model is the basis for cost estimates by applying cost estimating relationships and cost factors to specified physical characteristics. These models may be complex and computer assisted or may consist of a few relatively simple equations readily computed by hand. The study should identify and describe all cost models used so that the reviewer or decision maker can determine the validity of the model used and how the total system cost estimates were derived from the material in the study. If this material does not permit the reviewer to do this, then more information is required.

b. Are the Cost Estimates Relevant? Deciding which costs are relevant requires analysis and judgment. Preparing a universal list of always relevant costs is not possible. Ideally, a study should indicate why certain costs were considered relevant and why others were omitted. This does not mean that costs which are a significant part of the total cost should be excluded as "wash" costs. Ideally all relevant costs should be included in the analysis provided that the expense of collecting the data is outweighed by the benefit the data provides.

c. Are Sunk Costs and Inherited Assets Properly Treated?

(1) Inherited assets are those resources such as installations, equipment, and trained personnel inherited from efforts that are being phased out. The costs pertinent to planning are those yet to be incurred. Sunk costs are costs already expended. These previously incurred costs are usually excluded from costs presented in cost-benefit analysis.

(2) Including the costs of inherited assets and other sunk costs leads to distorted cost estimates with consequent effect on the conclusions and recommendations. On the other hand, if inherited assets have alternative uses, any relevant benefits and costs should be included in the analysis.

d. Are Directly Related Support Costs Included? Cost estimating of systems or organizations should include the proportionate cost of those other units or elements required in direct support. For example, the cost estimate of a new hospital must include the costs of the related direct and general support.

e. Are Replacement, Consumption, and Maintenance Costs Included? Cost estimates for major equipment items should include not only the operational equipment, but costs for those additional items required for initial stockage and replacement for the life of the system.

f. Are All Training Costs Included? The resource implications of training personnel can be significant. Initial training costs represent the resources for training personnel necessary for introduction of the alternative. The availability of fully trained personnel and the number of personnel requiring complete or

transitional training is the resource required. Annual training costs represent the resource implications for training replacements. These replacements are required because of usual attrition.

g. Are Construction Costs Included? The costs for additional installations or facilities are sometimes overlooked, yet these costs can be significant. Costs of facility rehabilitation should also not be overlooked.

h. Are the Cost Data Accurate?

(1) Cost data can be from many different sources and the analyst cannot check all cost data for accuracy. However, the analyst should spot check and examine the sources of the data. Cost data furnished by manufacturers should be viewed critically. These data may be understated particularly for new or advanced projects. Advanced system costs stated as an exact figure rather than at estimated lower and upper values are particularly suspect.

(2) Great accuracy in cost estimates is often not feasible. In fact, in dealing with costs of future acquisition, having a range of possible costs upper and lower values is usually more realistic than a single point cost estimate that implies no uncertainties.

i. Are Cost Aspects of All Alternatives Treated Equally? Inconsistency in handling the costs of competing alternatives prevents an objective evaluation and usually leads to wrong conclusions. However, using the same cost estimating technique for calculating a cost element is not always possible. The analyst should make sure the final dollar estimate accurately reflects the actual resource requirements for the alternative and that differences in estimating do not distort the cost results.

j. Are the Cost Estimating Relationships Valid?

(1) Cost estimating relationships may be unsophisticated cost factors, simple extrapolation of recent experience, or complex equations with many variables. In all cases, the purpose of a cost estimating relationship is to translate a specification of a physical resource in to a cost.

(2) Cost estimating relationships should be based on current data, or distorted estimates may result. For example, the purchase price per pound for engines has increased over the years due to changes in metal alloy technology; the maintenance cost per flying hour for aircraft has increased significantly over the past years as more sophisticated aircraft have been introduced in to the force structure. In other words, taking old cost data and inflating that data to the project year does not always account for changes due to technology or efficiency.

k. Are Costs in Terms of Present Value? The costs or benefits of proposed alternatives will differ both in total dollars and in the percentage distribution of the total over the years included in the method of analysis. The present value or discounting technique is the means for equating dollars in any year to dollars of the present. Using this technique permits greater disclosure of and consistency in, identifying the resource implications of proposed investments. Present value calculations involve a discount rate or tables based on such rates.

l. Are Constant Dollars Used? An estimate is in constant dollars if costs are adjusted so that they show the level of prices in relation to the base year. When the historical cost data collected represent expenditures in different years, all costs must be converted to the base year. If cost sources are stated in nominal dollars, then the analysis may be done in nominal dollars.

m. Is the Sensitivity of Cost Assumptions Adequately Examined? In comparing costs of alternatives, deciding to what degree the results are sensitive to the cost assumptions is important. For example,

would 10 years of operations as opposed to 5 make a significant difference in the relative costs of the alternatives? The study must make clear the sensitivity of the cost estimates to the major cost assumptions.

5. Benefits:

a. Are the Measures of Benefits Identified? The study should clearly identify the standards or measures used for evaluating the benefits of the system or organization under study. The conclusions and recommendations cannot be properly evaluated, particularly when the study is based on equal cost alternatives, without prior evaluation of the measures of benefits.

b. Do the Benefit Measures Focus Attention on One and Ignore Others? In measuring benefits, one should be careful not to concentrate on only one or two objectives. This action suggests that other objectives are less important. The resulting conclusions and recommendations, implemented, may cause an imbalance and reduce the capability to achieve other objectives.

c. Is the Evaluation of Benefits Based on Straight Extrapolation? Occasionally a study may evaluate benefits by straight (linear) extrapolation from the measurement of benefits of a small units. For example, a hypothetical study may show that six men can produce ten widgets. An extrapolation stating that 100 widgets can be produced by sixty men may not be justified without supporting evidence. The error in straight or inferior extrapolation disregards the element of diminishing returns or marginal use.

d. Is the Impact of Other Operations Ignored? In measuring the benefits of a system or organization, consider the effects of other operations. For example, peak use of power, or vehicles, or people may have detrimental affects on related projects or activities. The "ripple effect" should be considered.

e. Do the Benefits of Future Systems Take Into Account the Timing of Benefits? The benefits of a proposed future system often depend on when it will be available for operational use and the total operational life span (economic life) of the system. In examining the effect of the time dimension on benefits, pay particular attention to the time between the present and the initial operational availability of the complete system.

f. Has the Sensitivity of Benefits to Changes in Assumptions Been Recognized? The benefits derived in analysis depend on the assumptions. The analyst should isolate the degree of dependence and determine if it is acceptable. Generally a good study will show the degree of dependence by various kinds of sensitivity or contingency analysis.

g. Are Some Aspects of Output Measurable? The treatment of immeasurable aspects of performance in the total measurement of benefit should be treated carefully. Measures of benefit obtained by quantifying study aspects such as morale or leadership can be misleading. At times, the only practical solution may be a qualitative discussion of these factors.

h. If Quantity Measures of Output Are Unattainable, is Comparison of Quality Feasible? In an economic analysis, where projecting output or computing quantifying measures is difficult, comparing on the basis of a quality assessment should be investigated. Various pertinent factors can be described and characterized by a "yes-no" or "good-fair-poor." Saying alternative A is more effective than B for a certain characteristic may be justified, even if we cannot quantify the difference. If A is more effective than B, and A is more effective than C, we have a partial ordering; that is, we cannot distinguish between B and C, but both are inferior to A.

i. Are the Benefit Measures Proper and Inclusive? The measures used to evaluate benefits should be both proper and inclusive. Failure to use meaningful measures of benefits is a major contributing factor to poor studies. Examining the benefits measures requires analysis and sound judgment.

6. Comparison and Selection. EAs may contain a number of models linking output and cost through logical interrelationships. For some studies, a single cost-benefit model may suffice. For others, there might be a benefit model and a cost-benefit model. The exact nature and number of these models will vary with the problem. The study should provide enough information and explanation for the reviewer to follow the logic by which the models relate cost and benefit. A benefit model relates measures of output to measures of performance in an operational context. A system and organization model describes the physical resources required to provide the performance used in the benefit model. A cost model relates dollar costs to the physical resources described in the system and organization model. A cost model applies cost estimating relations and factors; for example, the total future cost of acquisition ownership (R & D, initial investment, annual operating) for various systems. Included in these total costs are the development and procurement of the preferred items and also such additional costs caused by training of personnel, construction, equipment maintenance, etc. The cost-benefit model finally relates the costs of each alternative to its benefits under varying assumptions. Depending on the criterion, the model may compare benefits and costs of alternatives at equal cost, at equal benefits, or at different costs and different benefits.

a. Are the Models Intuitively Acceptable? Models tend to become mathematical and many are difficult to understand even in their broad aspects. Yet, overly simplified models tend to become superficial by limitation in choice of detail and omission of important variables. The objective of a good model is to be close enough to reality so that the model outputs can be used to predict some of the future within an acceptable degree of probability.

b. Are the Criteria Identified? The criteria, or tests of performance, are the base for the conclusions and recommendations. The criteria should be stated specifically and clearly.

c. Are the Criteria Consistent With Higher Echelon Objectives? No matter what the concern of a study, the subject falls into a larger framework. Are the criteria used in a study consistent with higher-level objectives? This requires management judgment and the necessity to examine the larger context of the problem. If the study criteria are not consistent with objectives at the higher level, then the wrong problem may be addressed (suboptimization). An example of incorrectly chosen criteria is illustrated in using mobility as the sole criterion in the selection among different organizations. A study could conceivably show that organization A can be more mobile than organization B and C by spending fewer resources. Yet A may not be the preferred organization because the mobility was achieved by degrading other factors contributing to the higher objective of efficient control and management.

d. Are the Criteria Too General? Very general criteria should be suspect. For example, a study may state the criterion as being "the system with maximum military worth" or the "best system." These generalizations cannot be related to the analysis as can a good criterion such as the minimum cost of maintaining a specified level of transport capability over a specified time span."

7. Documentation and Data Evaluation:

a. Is the Analysis Adequately Documented? A key element of orderly analysis is sufficient documentation of method and sources so that with the same material, a reader not familiar with the study could

arrive at essentially the same result. Without documentation, an analysis appeals for acceptance solely on faith in the authority of the issuing agency.

b. Are the Facts Correct? It is usually not possible to verify all the facts from a variety of sources used as a study. Facts on which conclusions and recommendations depend should be specifically evaluated. Source references should be examined critically and documented in the study.

c. Are the Facts Stated With Proper Qualifications? In addition to checking the validity of the facts, completeness should also be evaluated. Some material may be correct in isolation but may take on a different meaning when other facts are added. For example, a bulldozer may generally be able to move "x" cubic yards of earth per day. However, this rate may not be valid for earth removal in rocky terrain.

d. Are the Data From Supporting Simulation Models Valid?

(1) Studies sometimes use the results of simulation models as facts. In evaluating these facts, one should bear in mind the nature of simulation. Basically, a simulation involves an abstraction from the real world. Models are structured according to mechanistic rules or judgments or both and these are made by persons. These rules and judgments are based on assumed situations and known or assumed facts and system characteristics.

(2) In determining the validity of simulation results, the analyst should judge how well the model portrays the essential relationships and should satisfy himself or herself on the validity of the judgments and assumptions used in conducting the analysis. Major judgments and assumptions used in the model should be fully identified.

e. Are the Performance Characteristics Valid?

(1) Performance characteristics are often the key element in determining the benefits of a system or piece of equipment. In evaluating the validity of performance characteristics, the source of the data should be examined. Performance characteristics based on a manufacturers claims are often optimistic. Performance characteristics derived from tests at research installations also require examination.

(2) Test performance characteristics are usually derived under controlled conditions. Performance characteristics derived from the field tests must be examined. Such tests can, at times, produce misleading results due to artificiality's caused by abnormally stringent operating and safety regulations and choice of test areas.

f. Are Any of the Data Derived From Questionnaires? The data obtained from questionnaires should be examined to determine the validity of the questions, the adequacy of the qualifications of the survey population, and the size of the population.

g. Are Intuitive Judgments Identified? At times, filling in data gaps with judgments is necessary but should be identified in the study. The impact of these judgments on the conclusions and recommendations should be evaluated.

8. Conclusions and Recommendations:

a. Are the Conclusions and Recommendations Logically Derived From the Material in the Study? The conclusions and recommendations should be derived logically from the material contained in the study. Some studies, unfortunately, draw conclusions based on previous studies and materials that are not

fully documented within the study (mention in a bibliography is not enough). If input from another study is essential, you should document and explain it in detail. This requires at least a statement of the validity, scope of application, and uncertainty related to the particular input.

b. Have All the Significant Consequences Been Considered in Arriving at the Conclusions and Recommendations?

(1) Sometimes a study fails to consider all the pertinent consequences in arriving at the conclusions and recommendations of the study or the decisions to be made because of the study. These consequences are often referred to as "spillovers". For example, if a study recommended adoption of an engine requiring a new type of fuel, the supply system to include supply, storage, and transportation operations would be affected.

(2) Spillover effects are not always negative. For example, adopting dehydrated rations to achieve greater shelf life may also reduce construction and transportation costs because of the smaller unit volume of dehydrated food.

c. Are the Conclusions and Recommendations Really Feasible in the Light of Political, Cultural, Policy, or Other Considerations? At times some recommendations of a study may appear to be eminently feasible from a strictly economic or military view but are really not so in the light of other considerations. For example, a particular waste disposal system may be shown to be superior, considering cost and effectiveness, to a high technology system for doing the same function. However, because of national policies on pollution and the environment, adopting the high technology system may be the only acceptable solution.

d. Do the Conclusions and Recommendations Show Bias? Studies sometimes unwittingly show bias because of parochial or institutional interests. One test for bias is to judge whether largely the same conclusions and recommendations would be reached, based on the material in the study, by another study agency.

e. Are the Conclusions and Recommendations Based on Outside Considerations?

(1) Occasionally, recommended selections among alternatives must be made in the face of great uncertainty. A study may find several alternatives exhibiting similar costs and benefits, but the results are very sensitive to the values assigned to the inputs.

(2) In this situation, some studies arrive at conclusions and recommendations based on considerations other than those studied. In other words, the study agency is stating, after the analysis was made, that applying the criteria did not lead to preference, but indifference among the alternatives, and therefore, the issue was decided based on other unstudied criteria. In situations of this kind, when recommendation of an alternative is necessary, sensitivity to new criteria must be fully studied.

f. Are the Conclusions and Recommendations Intuitively Satisfying? When the conclusions and recommendations of the study are not intuitively satisfying, one should try to isolate the cause. If the study fails to show by data, models and other means that your intuition was wrong, further examination is required to determine if some subtle considerations have been neglected because of oversimplification or other reasons.

Attachment 8**FORMATS****FORMAT A--SUMMARY OF COSTS FOR ECONOMIC ANALYSIS**

1. Submitting Organization:

2. Type of Submission:

3. Project Title:

4. Description of Project Objective:

5. Alternative:

6. Economic Life:

7. Program/Project Costs:

a	b.	c.	d.	e.	f.
Project	Nonrecurring	Recurring	Annual	Discount	Discounted
year	R&D Investment	operations	cost	factor	annual cost

1.

2.

3.

8. Totall

9. Total Discounted Project Cost (from Line 8, Column 7.f.). \$ XXX

10. Uniform Annual Cost (UAC) (without terminal value) (Line 9 divided by Line 8 entry for Column 7.e.) .. \$ XXX

11. Discounted terminal value . \$ XXX

12. Net Total Project Cost (discounted) (Line 9 minus Line 11) \$ XXX

13. Uniform Annual Cost (with terminal value) (Line 12 divided by Line 8, Column 7.e.). \$ XXX

14. Source/Derivation of Cost Estimates (Use as much space as required.) Sources should be included for all costs, including the following (if applicable):

a. Nonrecurring Costs:

(1) Research & Development.

(2) Investment.

b. Recurring Costs.

c. Net Terminal Value.

d. Other Considerations.

Note: If sources were cited in the body of the EA, they need not be repeated here. Calculations must be traceable down to their most basic inputs.

15. Name, Title, and Phone Number of Principal Action Officer:

Date:

FORMAT A COMMENTS:

Line 5: Indicates the alternative being considered for attainment of the project objective. Generally a Format A is submitted for every feasible alternative which has been costed in the economic analysis. Format A, and the other formats in this instruction, may be modified to fit the special features of a particular analysis.

Line 6: Indicates the economic life of the project for which the alternative is being proposed. This period may be either equal or unequal to the physical or technological lives of the investment. If the requirement for the project is longer than the economic life of any particular investment, future investment may have to be included in the analysis.

Column 7a: Indicates the years into the future that the project or program will exist.

Column 7b: Nonrecurring investment costs, corresponding to the Column 7a project year during which they will be incurred. These costs should include all costs not categorized as recurring or operational costs. These costs may include: initial investment, future overhaul of equipment, future renovation of facilities, installation and start-up costs, equipment relocation, and freight charges. In Column 7b, Research and Development (R&D) costs are separated from other investment costs. If there are no R&D costs, the format may be modified to include only one column under Column 7b for investments.

Column 7d: Includes the total incurred costs, obtained by summing Columns 7b and 7c, in relation to the project year indicated in Column 7a.

Column 7e: Discount factors, which should be mid-year, can be generated by computer spreadsheets using a formula (see attachment 10 of this instruction).

Column 7f: Discounted annual cost is obtained by multiplying Column 7d, Annual Costs, times Column 7e, Discount Factor. The product is the present value of the annual costs.

Line 8: The totals row includes the totals of Columns 7b through 7f. Column 7e total should include only those factors corresponding to years in which recurring costs occur. Column 7f total is the total project cost (discounted) and is also entered on Line 9, Total Discounted Project Cost.

Line 9: From Line 8, Column 7f.

Line 10: Uniform annual cost, sometimes called "equivalent annual cost," is calculated by dividing the total discounted project cost (Line 9) by the sum of the discount factors of the years in which recurring costs occur (ordinarily from Line 8, Column 7e, Discount Factor).

Line 11: The discounted terminal value is determined by multiplying the anticipated terminal value by the discount factor corresponding to the year in which terminal value will be realized. If terminal value is not applicable in a project or is zero, "NA" or 0 should be entered here.

Line 12: Line 9 minus Line 11.

Line 13: Line 12 divided by Line 8, Column 7e.

Line 14: Documentation of sources, including office symbols, points of contact, and dates of factors or rates is extremely important to enable reviewers to assess the reasonableness of estimates.

FORMAT A-1--SUMMARY OF DIFFERENTIAL COSTS FOR ECONOMIC ANALYSIS

1. Submitting Organization:

2. Type of Submission:

3. Project Title:

4. Description of Project Objective:

5. a. Present alternative: 6. a. Economic life:
 b. Proposed alternative: b. Economic life:

7. Year	8. Recurring cost	9. Differential cost	10. Discount factor	11. Discounted differential cost
	a. Present alternative	b. Proposed alternative		
1.				
2.				
3.				

12. Totals

13. Present Value of New Investment:

a. Land and buildings_____

b. Equipment_____

c. Other (identify nature)_____

14. Present value of new investment_____

15. Plus: Present value of existing assets employed on project:_____

16. Less: Present value of existing assets replaced_____

17. Less: Present value of the terminal value of new investment_____

18. Total present value of investment_____

19. Present value of savings from operations (col 11)_____

20. Plus: Present value of the cost of refurbishment or modification avoided_____

21. Total present value of savings (line 19 plus line 20)_____
22. Savings/investment ratio (line 21 divided by line 18)_____
23. Source/Derivation of Cost Estimates (use as much space as required):
- a. Investment Costs (itemize project costs)
 - (1) New investment; value of assets employed; value of existing assets replaced
 - (2) Net terminal value.
 - b. Recurring Cost (operations):
 - (1) Personnel.
 - (2) Operating.
 - (3) Overhead Costs.
 - c. Other Considerations:

24. Name, Title, and Phone Number of Principal Action Officer:

Date

FORMAT A-1 COMMENTS:

Lines 6a & 6b: Economic lives must be equal, or placed on an equal basis for the purposes of analysis, to use Format A-1. See paragraph 1.7.4.

Column 7: Years in which any costs will be incurred.

Column 8a: Operating costs of present system (or upgraded status quo baseline), corresponding to years in which incurred (may not occur during every project year).

Column 8b: Operating costs of proposed system, corresponding to years in which incurred.

Column 9: Year-by-year savings attributable to differential operating costs (Column 8a minus column 8b).

Column 10: Discount factors corresponding to the years in Column 7.

Column 11: Year-by-year present value of operating savings (Column 9 times Column 10).

Line 12, Totals: Totals for Columns 8 through 11.

Lines 13a through 13c: Present values of new investments (i.e., investments in assets not on hand, new assets for which funding must be obtained).

Line 14: Total of Lines 13a through 13c.

Line 15: Present value of assets on hand that will be used on the proposed alternative and are not currently used on the present alternative (i.e., equipment removed from storage or taken from another organizational element); assets to be used, but for which outside funding is not required. Subtracted from this present value will be the present value of any future income received from salvage of these assets.

Line 16: Present value of assets that are used on the present alternative but will not be used if the proposed alternative is adopted; the assets will be sold, made available for use by other organizations, or used on another project. Subtracted from this present value will be the present value of the salvage income that would be received from these assets if the present system was continued (i.e., the proposed system is not adopted).

Line 17: Present value of eventual salvage income from assets listed in Lines 13a through 13c.

Line 18: Line 14 plus Line 15 minus Line 16 minus Line 17.

Line 19: Present value of operations savings; sum of Column 11.

Line 20: Present value of a current asset overhaul or modification that will not be required if the proposed alternative is adopted; savings due to elimination of need of overhaul of current assets.

Line 21: Line 19 plus Line 20.

Line 22: Line 21 divided by Line 18.

1. Submitting Organization:
2. Date of Submission:
3. Project Title:
4. Description of Project Objective:
5. Alternative:
6. Economic Life:
7. Outputs:
 - a. Expected Benefits, Output, and Indicators of Effectiveness (Describe and Justify):
 - b. Non-Quantifiable Benefits (Describe and Justify):
 - c. Present Value of Revenues (Describe and Justify):
8. Source or Derivation of Outputs (Use as much space as required):
 - a. Benefits Performance, and Indicators of Effectiveness:
 - b. Nonquantifiable Benefits:
 - c. Present Value of Revenues:
9. Name and Title of Principal Action Officer:
Date:

FORMAT C--SUMMARY OF COSTS FOR ECONOMIC ANALYSIS

1. Submitting Organization:
2. Date of Submission:
3. Project Title:

4. Description of Project Objective:

5. Alternative:

6. Economic Life:

7. Program/Project costs:

a. Project	b. Nonrecurring Costs		c. Recurring Costs		d. Annual Costs		e. Dis- count Factor	f. Discounted Annual Cost (d X e)
Year	(1) Constant \$	(2) Inflated \$	(3) Con- stant \$	(4) Inflated \$	(1) + (3) Constant \$	(2)+(4) Inflat- ed \$		
	R&D In- vestment	R&D In- vestment						Constant \$ In- flated \$
1.								
2.								
3.								
						Con- stant \$		Inflated \$

8. Uniform annual cost:

a. Without terminal value_____

b. With terminal value_____

9. Discounted total cost without terminal value_____

10. Source/derivation of cost estimates (use as much space as required):

a. Nonrecurring costs:

(1) Research & Development

(2) Investment

b. Recurring costs

c. Net terminal value

d. Other considerations (include discount factor(s) and justification)

11. Name, title, and phone number of principal action officer:

Date:

FORMAT C-1--SUMMARY OF COSTS FOR ECONOMIC ANALYSIS

1. Submitting Organization:

2. Type of Submission:

3. Project title:

4. Description of project objective:

5a. Present alternative:

6a. Economic life:

b. Proposed alternative:

b. Economic life:

7. Project Year	8. Recurring operations costs (constant dollar)	9. Recurring operations cost (inflated dollars)	10. Differential costs	11. Discount Factor	12. Discounted differential cost
-----------------	---	---	------------------------	---------------------	----------------------------------

a. Present alternative	b. Proposed alternative	a. Present alternative	b. Proposed alternative	Constant \$	Inflated \$	Constant \$	Inflated \$
------------------------	-------------------------	------------------------	-------------------------	-------------	-------------	-------------	-------------

1.

2.

3.

13. Totals	Constant \$	Inflated \$
------------	-------------	-------------

14. Present value (PV) of new investment by type of investment:

a. Land and buildings

b. Equipment

c. Other (identify nature)

15. Total PV of new investment
16. Plus: PV of existing assets to be employed on the project
17. Less: PV of existing assets replaced
18. Less: Terminal PV of new investment
19. Total PV of investment
20. PV of cost savings from operations
(Totals for Column 12)
21. Plus: PV of the cost of refurbishment or modification avoided.
22. Savings/investment ratio (line 22 divided by line 19)_____
23. Source/derivation of cost estimates (use as much space as required):
 - a. Investment cost (itemize project costs):
 - (1) New investment; value of assets employed; value of existing assets replaced
 - (2) Net terminal value
 - b. Recurring cost (operations):
 - (1) Personnel
 - (2) Operating
 - (3) Overhead costs
 - c. Other considerations: (include inflation factor(s) and justification)
24. Name, title, and phone number of principal action officer.

Date:

FORMAT D--RANKING OF ALTERNATIVES

Submitting Organization:

Date of Submission:

Project Title:

Description of Project Objective:

Alternative	Discounted Cost	Cost-Benefit Ratio
Alternative A	\$000	
Alternative B	\$000	
Alternative C	\$000	

Attachment 9

MONETARY AND NONMONETARY COSTS AND BENEFITS

A9.1. Monetary Costs. Monetary costs associated with an alternative include prices paid to acquire, maintain, or operate a project or activity. Some may be known precisely, such as rents to be paid for buildings or equipment leases, while others may vary or be uncertain. Monetary benefits include revenues and government earnings from a program, such as royalties, lease fees, rents, salvage value, etc.

A9.1.1. Categories of Monetary Costs. Some standard terms used to classify or to describe various categories of monetary costs include:

A9.1.1.1. Life-cycle Costs. The total cost to the government from beginning through implementation and operation for the entire useful life of an alternative is known as the life-cycle cost of that alternative. All relevant resources required to achieve the stated objective throughout the alternative's useful life are to be shown in the analysis. Costs of each alternative which are required to meet the objective should be exhaustive. Costs should be carefully analyzed to determine whether or not they are included under the scope of the objective. Closely associated costs which do not contribute to an objective may be excluded. For example, an EA on vehicle acquisition and maintenance does not have to include vehicle operations costs since operations do not fall under the scope of acquisition and maintenance. However, in this example, any impact on vehicle operations should be discussed, especially if benefits are affected. Outside of DoD "wash costs" or "common costs" are often excluded from the economic analysis process. The DoD position is that all costs of each alternative should be identified. In practice it has been found that failing to identify all costs can easily lead to decisions being made on what in reality is incomplete and partial information. (A-76 commercial activity costing procedures, following AFI 38-203 and AFMAN 38-209, use a common cost method as directed by OMB.) If particular costs in an economic analysis are judged to be very small and difficult to measure due to lack of data, then a discussion of such costs should be included in narrative format so that decision makers and reviewers will be aware of them. The specific measure of life-cycle cost is the annual cost of the alternative discounted to its present value and summed over the entire economic life of that alternative; or, in other words, the present value of the total cost stream. Life-cycle costing provides logical and comprehensive information on programs and projects; its focus is on the total resource implications of program decisions, implicitly considering the timing of expenditures. Sunk costs are discussed in paragraph A9.1.1.4.1. (**NOTE:** The categories of cost discussed here are not mutually exclusive. Life-cycle costs, for example, include both non-recurring and recurring costs, discussed below.)

A9.1.1.2. Nonrecurring Costs. Nonrecurring costs are one-time costs, unique to a specific phase of a project or mission, which usually take the form of initial capital or other unique expenditures; in general, they can be thought of as outlays designed to bring an activity or product "up to speed" or back to operating condition. Nonrecurring costs need not be limited to a single year. Included under this general heading are:

A9.1.1.2.1. Research and development costs.

A9.1.1.2.2. Investment costs. These are costs associated with the acquisition of equipment, real property, nonrecurring services, nonrecurring operations and maintenance (start-up) costs, and other one-time outlays. Some common types of investment costs are:

- Costs of acquisition, rehabilitation, or modification of land, buildings, machinery, equipment, and one-time computer software costs.
- Costs of acquisition, rehabilitation, or modification of other capital items such as furnishings and fittings required for the project.
- Costs of plant rearrangement and tooling associated with the project.
- Costs of freight and insurance required by the project.
- The value of nonrecurring services received from others, both internal and external to the Air Force.
- The costs of leaseholds required for the project.
- Working capital and current assets on hand or on order, including inventories of consumable items and resources required for the project.

The imputed value of existing Air Force assets to be employed on the project. Concerning existing assets, the investment for a given project may consist of assets to be acquired plus existing assets. The value of existing assets should be included only when there is an opportunity cost associated with use of the asset. Opportunity cost is the cost of a resource measured in terms of its value in the best alternate use. Opportunity cost can include, for example, the cost imposed by one activity on another by diverting an existing asset from the latter to the former. If use of an existing asset would result in a cash outlay for some other project or activity, a cost which the government would not have otherwise incurred, that value should be included in the analysis as the cost of using that asset. When included, existing assets are valued at their opportunity cost value (as measured by market price, scrap value, or new cost adjusted for depreciation) and the basis for arriving at the estimate must be documented.

A9.1.1.3. Recurring Costs. The annual or periodic costs required to operate and maintain a program or project. Recurring costs involve the routine operation of the activity and any periodic costs required to maintain the activity in operation, such as the replacement of subsystems associated with a facility. Recurring costs include:

A9.1.1.3.1. Personnel Costs. All direct and indirect costs related to both civilian and military personnel. The cost of civilian personnel services includes gross pay, as well as the government's contribution for retirement and disability, health, and life insurance. If labor costs are determined by direct labor hours, the pay rate should be increased to cover leave and other benefits such as true average cost of sick leave and annual leave, holiday and other paid leave accruals, plus the average government contribution for all benefits. The cost of military personnel services includes annual composite pay and permanent change of station costs. Annualized retirement costs must also be included. Costs for travel, per diem, moving expenses, and training should be included for both civilian and military personnel. Factors for estimating personnel costs are in AFI 65-503.

A9.1.1.3.2. Supplies and Material. Besides material consumed in use, this includes transportation costs directly identified with the costs for handling, storage, and protection of property, and the cost of utility services such as electric power, gas, water, and communications-related costs.

A9.1.1.3.3. Maintenance and Repair Costs. Maintenance and repair of buildings, grounds, and equipment are often recurring costs. Also, the costs of terminating or canceling any exist-

ing arrangement required as the result of selecting an alternative should be included. Travel costs and personnel time lost when traveling to diverse locations is often overlooked when finding the cost of maintaining scattered facilities.

A9.1.1.4. Miscellaneous Costs. Other categories of cost include sunk costs and depreciation.

A9.1.1.4.1. Sunk Costs. Funds already expended at the time of the analysis are known as sunk costs. In the context of an analysis, these are expenditures which have already occurred, and thus are beyond the reach of the decision maker. Such costs have been irrevocably committed to a program or project and have no bearing on comparative cost studies. They should not be included in a cost comparison, but may be shown separately as supplementary information. For example, if \$1 million has been expended in research and development leading to item A, with acquisition of the new product requiring an additional investment of \$500,000, and item B is proposed as an alternative and will require an investment of \$750,000, the relevant cost comparison is \$500,000 versus \$750,000, not \$1.5 million versus \$750,000. However, the imputed value of existing assets employed to meet an objective, even if such assets have already been purchased, should be included as discussed in paragraph A9.1.1.2. This is consistent with the concept of opportunity cost--decision makers could employ these assets for an alternate use, and the cost of their use to reach the objective undergoing analysis should be recognized.

Depreciation accounts for the gradual consumption of capital goods and resources over time. A common use is to allow business to "recover" investment in capital goods through tax benefits. Normally, depreciation will not be included as a cost in an Air Force economic analysis since it would double count expenses (i.e., the acquisition cost of assets are entered when the asset is acquired). However, depreciation procedures can be used to estimate terminal or residual values. Also, it may be a consideration in commercial lease versus buy alternatives if it provides extraordinary tax benefits to the lessor that are a cost to the Treasury (see attachment 11).

A9.2. Monetary Benefits. Monetary benefits are incorporated into the analysis as offsets to expenditures. Revenues, government earnings, and the like are subtracted from the cost total to yield net costs or net dollar outflows for each alternative.

A9.3. Nonmonetary Costs and Benefits. Determining the total costs and benefits of a project involves not only dollar trade-offs but trade-offs of noncash factors as well.

A9.3.1. The selection of any particular alternative should be based on full economic evaluation (i.e., both quantifiable and non-quantifiable factors), including the consideration of significant values such as mission effectiveness, security and organizational morale. Thus, an alternative selected solely on the basis of lowest net dollar costs may not be the most economical option; other options may, after incorporation of nondollar costs and benefits into the analysis, provide more benefits for the resources expended.

A9.3.2. Estimation of nonmonetary costs and benefits is made easier if they can be categorized systematically and then compared within categories. Characteristics such as product or service performance (miles/hour, orders/hour) or work environment (average noise level, mishaps/week) can sometimes be quantified in nonmonetary terms. In such cases, direct comparisons among these measures should be undertaken. Nonmonetary costs and benefits should be quantified to the greatest

extent possible. Narrative description of a characteristic as a cost or a benefit may supplement quantification. However, relying on narrative description alone should be a last resort after every effort has been made to develop criteria for quantification.

A9.4. Sources of Cost and Benefit Data. Cost and benefit calculations should be based on the most accurate data available; case specific data (i.e., data pertaining to the project or circumstances at hand) should be used to the greatest extent possible; otherwise, average values from a variety of sources can be used. When future costs or benefits are uncertain (e.g., because of the nature of the forecasting process), sensitivity analysis should be used to evaluate the risk attending the estimate used.

A9.5. Comparison of Costs and Benefits. Alternatives are compared and ranked in order to aid decision making. When costs and benefits are brought into clearer focus, comparison is easier. Frameworks for comparing and ranking alternatives are outlined below:

A9.5.1. Equal Benefit--Equal Cost. In a case where benefits equal costs, no comparative evaluation would be necessary because it amounts simply to a coin toss like decision. While possible in theory, the analyst is unlikely ever to encounter such a situation.

A9.5.2. Equal Benefit--Unequal Cost. In the case of equal benefits among choices, the alternative with the lowest cost should be recommended.

A9.5.3. Unequal Benefit--Equal Cost. It is possible to produce alternatives that are equal in cost. An example of this is force structure analysis. If a maximum dollar level constraint is imposed then this scenario could occur. Obviously, if the costs are equal then the alternative with the greatest benefits should be recommended.

A9.5.4. Unequal Benefit--Unequal Cost. This is both the most common and most difficult to arrange for comparison. One approach is to rank the alternatives from least to most costly and then arrange the benefits to see how they stack up with each additional increment of cost. In this situation, a cost-benefit ratio should be calculated to help determine the optimal solution.

A9.6. Quantifying Benefits and Calculating Cost-Benefit Ratios:

A9.6.1. In order to complete a cost-benefit analysis, an analyst must quantify the perceived benefits accruing to each alternative. He or she must then compare those benefits to their costs (normally through a cost-benefit ratio). This allows a decision maker to evaluate the relative cost of alternatives in regard to the benefits received for each of those alternatives.

A9.6.2. Quantifying benefits involves a subjective ranking and weighting of benefits. (Sometimes analysts express concern about the subjective element in this assessment. However, it should be kept in mind that initial subjective evaluations will be reviewed by functional experts and other reviewers in the chain of command, which increases the objectivity of the assessment. Also, the goal of economic analysis is rational decision making--we are not dealing with the exacting criteria of scientific verification.) One can use a numerical scale to rank each alternative's benefits relative to the others. Additionally, one should weight the relative value of each benefit. (While it would be possible for each benefit to be valued equally, this would seem to be an unlikely occurrence.)

A9.6.3. As an example, suppose an analyst has three alternatives (i.e., A, B and C) as illustrated in table A9.1. Reflecting upon the proposed project, the analyst uses four benefits to compare alterna-

tives (one should not constrain oneself to the benefits illustrated in this example, but should examine each particular project). The analyst weights (i.e., puts a relative value on) each benefit.

Subsequently, mission readiness may be the most important benefit when compared to the quality of facility, safety and security. One then weighs these benefits by comparing the relative worth of mission readiness, the most beneficial in this case, to security, the least beneficial category. The analyst believes that mission readiness is four times the value of security; quality of facility is three times more important than security; and safety is one and a half times the worth of security. These values are illustrated in table A9.1 by putting the value within parentheses (e.g., mission readiness (4)). It is important to note that the assessment of the value of the benefits should be unique to each project. For example, a particular function may not need to be constantly ready, whereas their operation may involve dangerous activities (e.g., a laboratory). In such a case, safety may well be more important than readiness. The analyst must carefully reflect on the benefits involved in each project, in consultation with functional representatives.

A9.6.3.1. The analyst now needs to measure the relative value of each alternative in terms of benefits received. The analyst selects a scale, e.g., from 0 to 5. The value 5 indicates the highest valuation and 0 indicates no benefit, with values from 0 to 5 selected by the analyst after judging the extent to which each alternative realizes each particular benefit. The value of the numerical scale is up to the analyst. As long as its use is consistent within the analysis, one could select many potential scale systems.

A9.6.3.2. The analyst now enters the values for each alternative's benefits. He or she multiplies the benefit scores by the weighted benefit value (see table A9.1) and sum the values for each alternative (e.g., the total for Alternative A is 29).

Table A9.1. Benefits Analysis.

Benefits	Alternative A	Alternative B	Alternative C
Mission Readiness	(4) x 3 = 12	(4) x 2 = 8	(4) x 2 = 8
Quality of Facility	(3) x 2 = 6	(3) x 2 = 8	(3) x 4 = 12
Safety	(1.5) x 4 = 6	(1.5) x 2 = 3	(1.5) x 2 = 3
Security	(1) x 5 = 5	(1) x 2 = 2	(1) x 0 = 0
Total	29	21	23

If one had an unconstrained budget, he or she might select Alternative A, since it has the highest benefits. Of course, budgetary limits need to be considered. Therefore, one needs to consider the relative cost per benefit by developing a cost-benefit ratio.

A9.6.3.3. Calculating Cost-benefit Ratio . Since the analyst has developed the cost of each alternative, the cost-benefit ratio can be calculated by dividing the cost of each alternative by the total score representing its respective benefits (see table A9.2). The result is that Alternative B seems the most beneficial since it costs less, per unit of benefit, for this alternative than the others.

Table A9.2. Calculating Cost-Benefit Ratio.

	Alternative A	Alternative B	Alternative C
Cost	\$2,500	\$1,000	\$2,000
Cost-Benefit Ratio	$\$2,500/29 = \86.2	$\$1,000/21 = \47.6	$\$2,000/23 = \87

Ordinarily the alternative with the lowest cost-benefit ratio, such as Alternative B in this example, is the recommended alternative.

Attachment 10**FORMULA FOR DISCOUNT FACTORS**

Ordinarily mid-year discount factors are used. The formula for generating such factors is:

$$F=1/((1+R)^{(Y-.5)})$$

Where F is the discount factor, R is the discount rate written as a decimal fraction, and Y is the sequence number of the year in question, beginning at program inception. The formula produces a unique factor for each year in an analysis. SAF/FMCE will provide annual updates to the discount rates to be used for economic analysis. The rates can be found on the Financial Management Analysis Bulletin Board. For analyses of short periods, monthly factors may be more appropriate. Mid-monthly discount factors may be generated using the following formula:

$$F = 1/(RM^{(M-.5)})$$

Where F is the discount factor, M is the sequence number of the month in question, and RM is the discount rate on a monthly basis, i.e., the 12th root of (1+R), or $RM = (1+R)^{(1/12)}$.

Attachment 11**LEASE-PURCHASE PROCEDURES**

A11.1. Intent. Whenever a Federal agency needs to acquire the use of a capital asset, it should do so in the way that is most economical to the government. Lease-purchase analysis conducted under Circular A-94 is intended to determine whether it would be more economical to lease or to buy a given asset. It is not intended to determine what kind of asset should be acquired, the quantity, or acquisition schedule. When a decision involves both aspects (e.g., a choice between leasing an asset this year and purchasing it next year) the economic analysis should first determine when, in what quantity, or on what acquisition schedule to acquire the asset, and then analyze the lease-purchase aspect of the overall decision using the principles outlined in this attachment.

A11.2. Applicability. OMB Circular A-94 lease-purchase analysis procedures are required when both of the following conditions are met:

- The analysis involves a capital asset or a group of related assets whose total fair market value exceeds \$1 million.
- The analysis involves a capital asset (including durable goods, equipment, buildings, facilities, installations or land) which:
 - Is leased to the government for a term of 3 or more years.
 - Is new, with an economic life of less than 3 years and is leased to the government for a term of 75 percent or more of the economic life of the asset.
 - Is built for the express purpose of being leased to the Federal government.
 - Is leased to the Federal government and clearly has no alternative commercial use (e.g., a special-purpose government installation).

Application of these procedures for analysis of asset leases valued at less than \$1 million is optional, though the Air Force requires an economic analysis if annual recurring costs exceed \$200,000 or the investment exceeds \$1 million. Circular A-94 procedures also are not required for service contracts that involve the use of capital assets by the contractor incidental to the provision of services to the government. Economic analyses of service contracts are governed by AFI 38-203. However, OMB may require any particular lease or service contract be subject to Circular A-94 provisions.

A11.3. Methods of Justification. All leases of capital assets must be justified as preferable to direct government purchase and ownership. In general, this can be done in one of three ways:

- **Separate Analysis.** This involves conducting a separate lease-purchase analysis on each lease of one or more capital assets by a government agency.

This is the only acceptable method for major acquisitions. A lease of one or more capital assets is a major acquisition if:

- 1) the acquisition represents a separate line-item in the federal agency's annual budget,
- 2) the agency or OMB determines that the significance of the acquisition merits designating it as major, or
- 3) the total value of the acquisition, as measured by the purchase price of the assets leased, exceeds \$500 million. Lease-purchase analyses of major acquisitions must be reviewed by SAF/AQ.

- **Generic Class Analysis.** In the case of recurrent decisions to lease similar assets for the same general purpose, by periodically conducting a lease-purchase analysis for the entire class of assets in question, using the same analytic methods used to evaluate individual leases. OMB approval should be sought in determining the scope of any such generic analysis.
- **Policy Approval from OMB.** Federal agencies may request approval from OMB of a formal policy that generally results in the same lease-purchase decisions as a requirement for lease-purchase analysis. Agencies must demonstrate that:
 - the leases in question would generally result in substantial savings to the government that could not be realized in a purchase,
 - the leases are so small or so short-term as to make separate lease-purchase analysis impractical, and
 - leases of different types are scored consistently with the instructions in Appendices B and C of OMB Circular A-11. Any such proposed policy must be approved by SAF/FM and SAF/AQ, and forwarded by the Secretariat through OSD to OMB for approval.

A11.4. Definitions and Analytic Methods. The definitions and methods below characterize the principles to be used in lease-purchase analysis.

A11.4.1. Life Cycle Cost. Lease-purchase analysis should include a net present value comparison of the life cycle cost of leasing to the full cost of buying or constructing an identical asset. The full cost of buying include the asset's purchase price plus any relevant ancillary services connected with the purchase. Terms of leases vary: the basic principle is that any services included in the terms of a prospective lease are also included, for purposes of analysis, in the purchase alternative, and vice versa.

A11.4.1.1. Ancillary Services. Are any services included either in the terms of the lease or the terms of the purchase. If, for example, services will be provided by the lessor but are not included in the purchase price, then the cost of obtaining these services separately should be added to the purchase price. Such costs may be excluded if they are estimated to be the same for both lease and purchase alternatives or too small to affect the comparison. If costs are excluded for these reasons, they must be addressed in the assumptions section of the analysis. Examples of ancillary services include:

- All costs associated with acquiring the property and preparing it for use, including construction, installation, site, design, and management costs.
- Repair and improvement costs.
- Operation and maintenance costs.
- Imputed property taxes (excluding foreign taxes on overseas acquisitions except where actually paid); imputed taxes approximate the costs of providing municipal services such as water, sewage and police and fire protection.
- Imputed insurance premiums. Imputed costs do not involve a direct monetary payment but are included in an analysis to provide a consistent basis of comparison.

A11.4.1.2. Economic Life. For purposes of lease-purchase analysis, the economic life of an asset is its remaining physical or productive lifetime. It begins when the asset is acquired and ends when the asset is retired from service. The economic life is frequently not the same as the useful life for tax purposes.

A11.4.1.3. Purchase Price. The purchase price of the asset for purposes of lease-purchase analysis is its fair market value, defined as the price a willing buyer could reasonably expect to pay a willing seller in a competitive market to acquire the asset. Estimates of fair market value may be obtained from catalogs, e.g., GSA catalogs, from vendor quotations or from data on recent purchases. **NOTE:** seeking vendor quotations should be done in consultation with acquisition or contracting personnel so that it is made clear that the government is conducting analysis and not making a commitment.

A11.4.1.3.1. In the case of property that is already owned by the Federal government or that has been donated or acquired by condemnation, an imputed purchase price should be estimated.

A11.4.1.3.2. If public land is used for the site of the asset, the imputed market value of the land should be added to the purchase price.

A11.4.1.3.3. The asset's estimated residual value, as of the end of the period of analysis, should be subtracted from its purchase price. A property's residual value is an estimate of the price that the property could be sold for at the end of the period of the lease-purchase analysis. The recommended way to estimate residual value is to determine what similar, comparably aged property is currently selling for in commercial markets. Alternatively, book estimates of the resale value of used property may be available from industry or government sources. Assessed values of similar, comparably aged properties determined for property tax purposes may also be used.

A11.4.1.4. Property Taxes. Imputed property taxes may be estimated in two ways:

- Determine the local property tax rate and assessed (taxable) value for comparable property; if there is no basis by which to estimate future changes in tax rates or assessed value, the first-year rate and assessed value (inflation-adjusted for each subsequent year) can be applied to all years; multiply the assessed value by the tax rate to determine the annual imputation for property taxes.
- Obtain an estimate of the current local effective property tax rate from the Building Owners and Managers Association's Regional Exchange Reports. Multiply the fair market value of the government-owned property (inflation-adjusted for each year) by the effective tax rate.

A11.4.1.5. Insurance Premiums. Imputed insurance premiums may be estimated by determining local estimates of standard commercial coverage for similar property from the Building Owners and Managers Association's Regional Exchange Reports.

Attachment 12

SPECIAL TAX ADVANTAGES IN LEASE-PURCHASE ANALYSIS

A12.1. OMB Circular A-94 specifies that in lease-purchase analysis the cost of leasing should include "...the cost to the Treasury of any special tax benefits associated with leasing such as the investment tax credit or the tax deferral provided by accelerated depreciation allowances." The Tax Reform Act of 1986 subsequently repealed the investment tax credit. The Deficit Reduction Act of 1984 together with the Tax Reform Act of 1986 effectively eliminate accelerated cost recovery system (ACRS) depreciation for assets leased by the US government, under most circumstances. Analysts should seek legal and contracting opinion to ascertain whether or not a given lease provides a favorable tax advantage to lessors or service providers (hereafter referred to simply as lessors). This may require obtaining an opinion from the Office of the Staff Judge Advocate servicing their organization. The procedures below show how to incorporate ACRS or MACRS depreciation tax losses to the Treasury into an economic analysis, should it apply due to future changes in the law. Neither normal taxes on income and profit nor ordinary depreciation of assets should be included as a cost or benefit to the government. For purposes of analysis, it will be assumed that ACRS or MACRS is not available to the lessor unless information to the contrary is available. If it is known that the lessor will take advantage of favorable tax provisions contained in ACRS or MACRS, then it will be assumed in the analysis that the lessor's marginal tax rate is the maximum corporate rate.

A12.2. ACRS and MACRS depreciation allowances are amounts that are subtracted from the lessor's taxable income. Therefore, only the portion of the total allowance in excess of normal "economic depreciation" contributes to special tax advantage. Accelerated depreciation schedules allow deductions greater than economic depreciation in the first few years of asset ownership. Since no more than 100 percent of asset value may be deducted during its life (by any one owner), this means that accelerated depreciation schedules provide smaller deductions in later years of ownership, compared to economic depreciation, and therefore tax disadvantages for these years. Altogether, ACRS or MACRS provides a tax advantage through deferral and the time value of money. The amount of taxes deferred in any year t is equal to $T(A_t - D_t)$ where A_t is the amount the lessor is able to deduct under ACRS or MACRS. D_t is the amount deductible under economic depreciation, and T is the marginal tax rate.

A12.3. An economic analysis compares the outlays associated with different alternatives; therefore, the tax deferral due to ACRS or MACRS, a revenue loss, must be made equivalent to an outlay by the Treasury. The cost to the Treasury of ACRS or MACRS, equivalent to a normal outlay, is

$$T(A_t - D_t)$$

$$(1 - T)$$

A12.4. For the later years of asset life, this sum is negative (i.e., for those years when economic depreciation exceeds ACRS or MACRS allowable deductions). The outlay-equivalent measure of tax losses should be added (effectively, subtracted for later years) to annual costs for the lease alternative in the economic analysis.

A12.5. Schedules of annual deductions allowed under ACRS or MACRS are available from Internal Revenue Service Publication 534. Computation of the annual amounts will differ under ACRS and

MACRS. The simplest way to estimate economic depreciation of an asset is by straight-line depreciation over its economic life. Therefore, annual economic depreciation of an asset is approximately equal to its acquisition price divided by its economic life, for each year of its economic life.

Attachment 13

COST-BENEFIT ANALYSIS (CBA) FOR GOVERNMENT FURNISHED PROPERTY AND EQUIPMENT IN SUPPORT OF COST COMPARISONS (OMBC A-76)

NOTE: Per AFI 38-203 and AFMAN 38-209, the decision whether or not to furnish government property to prospective contractors in a commercial activity (CA) cost comparison must be based on what is in the best interest of the government, as determined by an informal CBA. Government furnished property includes government-owned facilities, equipment (capital assets and minor items), real property and supply items.

A13.1. The informal CBA may, depending on the circumstances of the particular cost comparison, simply be a narrative explaining the rationale for the decision. Narrative documentation is appropriate when the decision appears to be self-evident, either because an alternative government use of the asset is not possible or practical, or because items are government-specific and can't readily be acquired by bidders. Under these conditions the steering group is responsible for the decision, and must document the decision by means of a memorandum for record to be included in the documentation of the cost comparison. In another situation, if the aggregate cost of the items under consideration is estimated to be less than the cost of accomplishing an explicit monetary CBA, then a narrative rationale supporting this judgment is sufficient. This judgment is the responsibility of the steering group, must be coordinated with the financial analysis office, and should be completely documented.

A13.2. If none of the conditions discussed above is applicable, then an explicit monetary CBA must be conducted by the financial analysis office. Because the question at issue in such a cost comparison is essentially how to fund accession of specified services, rather than any material question involving the allocation of national resources, the analytic methods of OMB Circular A-94 apply to this type of CBA. Establishing the costs and benefits to the government under each option (providing or not providing the property to potential contractors) requires estimation both of the implied incremental changes in the service contract price and of the collateral effects on other government activities as a result of the decision. In a competitive environment, one would expect that the availability of government property would tend to lower vendors' bids on the associated service contract. In the absence of other information, an estimate of the fair market rental value of a property or equipment item or government procured supplies would provide an approximation of the maximum extent to which a contractor's bid for the service contract could be expected to vary, based on whether or not the government-procured item was provided. An improvement to this estimate could be made if a history were available to demonstrate more closely the relationship between rental prices or other prices and the contract price adjustment contractors make, based on having use of the equipment. For example, a potential contractor may generally accomplish the activity in question by methods quite different than the methods used by the government. In such a case, providing equipment and supplies used by the government would tend to lower the contractor bid by less than the cost of those items. Opposite outcomes are also possible. Of course, rental prices would have to be adjusted based on who is responsible for equipment maintenance and what such maintenance entails.

A13.3. The cost to the government of furnishing an equipment item depends on its best alternative use. The value of an asset that can be applied directly to another government use should be set equal to the cost of acquiring an additional asset to accomplish the other activity, adjusted for depreciation. For example, an asset being considered for government furnished equipment (GFE) may have a 5-year economic life when new, and be 2 years old. Therefore, the cost to the government of furnishing that equipment is equal

to 60 percent of the cost of acquiring a new item. If similar but not identical assets are involved, adjustments can be made. An asset considered for GFE seldom has no alternative value. Ultimately, an estimate of the price for which an item could be sold in disposal puts a floor under the opportunity cost of providing that item to a contractor.

A13.4. Finally, CBA for government property in the context of a CA action is a contingent analysis--i.e., the analysis should illuminate the question of whether or not it is to the government's advantage to provide government property in the event the activity is performed by the contractor. Other arrangements would prevail if the activity in question is performed in-house.

Attachment 14**CONGRESSIONAL REPORTING REQUIREMENTS: CONVERSION OF A COMMERCIAL ACTIVITY****FROM IN-HOUSE TO CONTRACT PERFORMANCE (RCS: HAF-pem [AR] 8001)**

A14.1. Policy [Re: 10 USC 2461 and Public Law 96-342, as amended by Public Laws 97-145 and 99-661 (Hereafter "Section 502")]. This report is designated emergency code C-2. Continue reporting during emergency conditions, normal precedence. Submit data requirements in this category as prescribed or as soon as possible after submission of priority reports. Discontinue reporting during MINIMIZE.

- a. If more than 75 DoD employees will be affected by the cost comparison, then a statement showing the potential economic effect on employees affected, and the potential economic effect on the local community and the Federal Government is required. [RCS: HAF-PEM (AR) 8001]
- b. Upon request of manpower offices, cost offices prepare a report showing the estimated economic effect on the local community. Preparation of this report is unrelated to the independent review and causes no conflict with the review because the report is not part of building the cost comparison.
- c. For cost comparisons involving 250 or more workyears, development of this report should be done in close and early consultation and formal coordination with installation and MAJCOM civil engineering and comptroller staff to ascertain potential community and intergovernmental impact.

A14.2. Procedure:

- a. The report is developed by using data from the cost comparison in conjunction with an Economic Impact analysis of the installation (see chapter 4 of this instruction).
- b. The specific procedure to follow is included below (after paragraph 4).
- c. For cost comparisons of 250 or more workyears, the methods outlined below may be supplemented by analysis developed in cooperation with civil engineering and comptroller staff. This supplementary analysis must be sufficiently thorough to provide an adequate analysis of economic and intergovernmental impact.

NOTE:

ANG units which are tenants on regular Air Force or Reserve installations, or ANG installations which are in close proximity to such regular Air Force or Reserve installations, may use economic impact analyses for these installations.

A14.3. Reporting:

- a. The summary statement is included in the procedure below (Step 5).
- b. If 2C (above) is applicable, a statement summarizing the results of the analysis must be prepared for inclusion in the RCS: HAF-PEM(AR) 8001. This summary statement should be similar to the summary statement contained in Step 5 of the procedure below, summarizing potential economic or intergovernmental impact on the AFI surrounding community.

A14.4. Documentation Requirements: Documentation for the report should be maintained on file using a Memorandum for Record or copy of the letter transmitting the report to the manpower office. Documentation for the commercial activities program is maintained according to AFR 4-20, volume 2, table 26-1.

PROCEDURE FOR COMPUTATION OF ECONOMIC IMPACT FOR A-76 COMMERCIAL ACTIVITY COST COMPARISONS

STEP 1: Use Data from the A-76 Cost Comparison Study. Obtain the figure for the "cost advantage in favor of contracting" from the RCS: HAF-PEM (AR) 8001 which is prepared by the Management Engineering Team. Annualize this data by dividing the figure by the number of years in the contract. In this example, the cost advantage in favor of contracting is \$14,000,000 and the number of years is 5:

\$-14,000,000 divided by 5 = \$-2,800,000 (Annual Cost Advantage in Favor of Contracting)

STEP 2: Use Data from the latest Economic Impact analysis. From table 4.3, obtain the figure for "Total Expenditure" In this example, total expenditures will equal \$250,000,000.

STEP 3: Calculation of Estimated Economic Impact (Percentage Change).

Divide Step 1 by Step 2:

$$\frac{\text{Annual Cost Advantage in Favor of Contracting}}{\text{Total Expenditures}} = \frac{\$-2,800,000}{\$250,000,000} = -.011 \times 100 = -1.1\%$$

(round to the nearest tenth of a percent)

STEP 4: Statement for RCS: HAF-PEM(AR)8001. Provide the following statement:

"Potential economic effect on the surrounding community. The economic impact of _____ AFB within the local community will be reduced by an estimated 1.1%.

STEP 5: Coordination with MAJCOM/FMA. Before finally releasing the statement for inclusion in the RCS: HAF-PEM(AR) 8001, coordinate with MAJCOM/FMA. MAJCOM/FMAs will provide SAF/FMCE (by message) with the following information:

Subject: [Provide function studied at _____ AFB.]

(RCS: HAF-PEM 8001).

1. The economic impact was estimated using the following:
 - a. Cost advantage in favor of contracting: \$14,000,000
 - b. Number of Years: 5
 - c. Annual advantage in favor of contracting: \$2,800,000 (a divided by b)
 - d. Total Air Force Base Expenditures in the Economic Impact Region from FY_____ EI analysis: \$250,000
 - e. Percentage reduction in economic impact: 1.1% (c divided by d)
2. Refer any questions to _____, DSN _____.

Attachment 15**CERTIFICATE OF SATISFACTORY WARRANTY COST-BENEFIT ANALYSIS**

Installation/MAJCOM: _____

Weapon System: _____

Program Element: _____

A Warranty Cost-Benefit Analysis (WCBA) has been performed on this weapon system in accordance with DFARS 46.770-8 and AFI 65-501. The WCBA evaluated the discounted present value of expected program costs, estimated both with and without warranty coverage and found a saving of _____ million dollars in life cycle costs due to warranty coverage after paying the price of the warranty. As a result of this analysis warranty coverage as outlined in the WCBA attachment 1 is recommended for this weapon system.*

Base Level Financial Analysis Evaluator:

(Signature)
(Typed Name/DSN/Date)

Base Level Financial Analysis Concurrence:

(Signature)
(Typed Name/DSN/Date)

Director, Program Control Concurrence

(Signature)
(Typed Name/DSN/Date)

Program Manager Concurrence

(Signature)
(Typed Name/DSN/Date)

MAJCOM FMC Concurrence

(Signature)
(Typed Name/DSN/Date)

Program Executive Officer Concurrence

(Signature)
(Typed Name/DSN/Date)

Send this Certificate to: SAF/FMC, with information copy to SAF/AQ.

* If savings are negative, then change the recommendation to warranty coverage is not recommended.

Attachment 16

REQUEST FOR WAIVER OF WARRANTY COST-BENEFIT ANALYSIS

Installation/MAJCOM: _____

Weapon System: _____

Program Element: _____

A Warranty Cost-Benefit Analysis (WCBA) was not prepared for this weapon system due to:

- a. Warranty data not available at this time. A WCBA will be performed during fiscal year _____ when data should be available.
- b. The projected cost (\$_____) of conducting a WCBA for this weapon system is expected to exceed the benefits (\$_____) based on experience as documented at attachment 1.
- c. A performance incentive has been written into the contract so that the prime contractor shares maintenance and operational costs when performance is degraded. A copy of the incentive provisions is provided at attachment 1.

Base Level Financial Analysis Evaluator:

(Signature)
(Name/DSN/Date)

Base Level Financial Analysis Concurrence:

(Signature)
(Name/DSN/Date)

Director, Program Control Concurrence:

(Signature)
(Name/DSN/Date)

Program Manager Concurrence:

(Signature)
(Name/DSN/Date)

MAJCOM Financial Analysis Concurrence:

(Signature)
(Name/DSN/Date)

Program Executive Officer Concurrence:

(Signature)
(Name/DSN/Date)

Send this Waiver Request to: SAF/FMC, with information copy to SAF/AQ.

Attachment 17**FOREIGN CURRENCY CONVERSION**

NOTE: This attachment provides additional guidance on and examples of foreign currency conversions. (Per paragraph 1.5, ordinarily do EAs in constant dollars; however, if your cost sources cite nominal dollars, you may do EAs in inflated dollars.) The guidance below addresses, in turn, constant and nominal dollar analysis. The guidance assumes you have collected some costs expressed in foreign currency.

A17.1. Constant Dollar Analysis. Obtain a forecast of the exchange rate for the fiscal year which will be the base year of the analysis (i.e., the first year in which there will be differences in expenditures for different alternatives). (If you cannot obtain local estimates, check the Financial Management Analysis Bulletin Board or, if not available there, ask your command counterpart to contact SAF/FMCE.) Use the exchange rate for that base year of the analysis to convert expenditures in every year. The resulting dollars are constant dollars of that base year, resulting in a constant dollar analysis.

NOTE:

Exchange rates are ordinarily cited on the basis of national currency unit per US dollar (e.g., Yen per dollar). An exception is often the British Pound Sterling, which frequently is cited as dollars per pound. Check your source for the basis of the rate.

A17.2. Nominal Dollar Analysis. Obtain a forecast of the exchange rate for each year of the analysis. Convert each year's foreign currency expenditures into dollars using the forecast exchange rate for each year. The resulting dollars are nominal dollars. If the forecast does not cover all the years in the analysis, use the exchange rate for the last year forecast for all remaining years. An alternate approach: use the exchange rate for the first year of the analysis to convert foreign currency into US dollars; then use a US inflation rate forecast to convert these constant dollars into nominal dollars.

A17.3. Sensitivity Analysis. Since currency exchange rates are subject to wide fluctuation over time, include a sensitivity analysis addressing exchange rate variations in every EA which has significant foreign currency purchases. Vary the exchange rates by plus and minus 25 percent, showing the effect on the ranking of alternatives.

Attachment 18

MARGINAL ANALYSIS EXAMPLE

Suppose the Air Force is considering the replacement of a facility, but this facility project is only one of many possible projects considered for a base. The decision-maker has four alternatives for this particular project: maintaining the status quo, renovating the facility, leasing a building off-base, or building a new facility. The following values were calculated for each alternative:

Alternative	Cost	Benefit	Cost-benefit Ratio
Status Quo	\$1,000,000	20	\$50,000
Renovate	\$2,500,000	100	\$25,000
Lease	\$3,000,000	150	\$20,000
Build New	\$5,000,000	500	\$10,000

A decision-maker, given just this project and unlimited resources would select the build new alternative. Recall, this project is one of many competing projects on-base. How does a decision-maker select among many projects with a limited budget? Marginal analysis is one method to assist in the decision process. In the above example, one could compare the differences among different alternatives and reformat the data to calculate marginal cost-benefit ratios (or marginal ratios). Normally, an analyst should compare the least costly alternative to the next most expensive alternative. In this case, he or she would compare the status quo to the renovate alternative. This would result in the following values:

Alternatives Compared	Cost Difference	Benefit Difference	Marginal Ratio
Status Quo vs. Renovate	\$1,500,000	80	\$18,750
Renovate vs. Lease	\$500,000	50	\$10,000
Lease vs. Build New	\$2,000,000	350	\$5,714

The decision-maker can now ask himself or herself whether the additional cost of each alternative is worth spending within their limited resources. Now suppose the decision-maker has only \$9,000,000 in the budget authorized for facility construction and must decide which alternatives to select between the above facility and another project with the following information.

Alternative	Cost	Benefit	Cost Difference	Marginal Ratio
Status Quo	\$2,000,000	50		
			\$1,000,000	\$20,000
Renovate	\$3,000,000	100		
			\$3,000,000	\$7,500
Build New	\$6,000,000	500		

The marginal ratio between the new project's status quo and renovate alternatives is \$20,000 (\$1,000,000 divided by the difference in benefits 50, from 100 minus 50). The marginal ratio between the renovate and build new alternative is \$7,500 (\$3,000,000 divided by 400, 500 minus 100). The decision-maker should select the alternative with the lowest marginal ratio first. Then allocate resources to the next project and select the alternative with the next lowest marginal ratio. The decision-maker should allocate \$5,000,000 in the first project to build new since it has the lowest marginal ratio. Next, with the remaining funds, spend \$3,000,000 to renovate the second project. The decision-maker cannot select the build new alternative in the second project since he or she will exceed the budget limit. Since the decision-maker has \$1,000,000 left in budget authority, he or she could try to get further appropriations by using the marginal ratio and showing other decision-makers how much more benefits the base would receive if they were given authority to build new versus renovating the facility. If the decision-maker had more facility projects, he or she could use a similar methodology to compare alternatives.

Attachment 19

PRELIMINARY ECONOMIC ANALYSIS FORMAT

A preliminary economic analysis is a concise tool for making a recommendation to a decision maker without going through the effort of a full EA. Preliminary EAs are internal planning tools for installations and commands. The goal is to bring the benefits of economic analysis to decision making early on in the process without being unnecessarily burdened by the more demanding requirements of a full EA. In no case may a preliminary EA be substituted for a full EA when a full EA is required by the provisions of AFI 65-501. The format suggested below is optional and intended to provide an idea of the contents appropriate for a preliminary EA, which is generally a document of no more than a few pages.

1. Problem/Requirement. Provide a brief, clear and accurate background statement about what needs to be addressed, e.g., 300 unaccompanied enlisted personnel are currently housed in substandard facilities (condition code 3 dormitories).

2. Objective. State the generic need in an unbiased, non-limiting manner, quantified to the extent possible, e.g., provide adequate housing for 300 unaccompanied enlisted personnel. If "adequate" can be translated into square footage or other parameters, this quantification should be done.

3. Assumptions/Ground Rules. Identify only the most significant limitations, constraints, assumptions, legal or regulatory considerations, e.g., all condition code 1 and 2 dormitories are currently averaging 95 percent occupancy, no present base organizations will be inactivated or relocated.

4. Alternatives. Identify, as a minimum, the most obvious alternatives. Categorize the alternatives in two groups: feasible alternatives to be analyzed (e.g., status quo, renovation, new construction, BAQ/VHA), or infeasible alternatives to be eliminated (e.g., leasing). Include reasons for eliminating infeasible alternatives.

5. Costs. Identify the major categories of costs and include preliminary estimates by major category. "Wash" or common costs may be excluded (unlike in a full EA). Ignore minor categories of cost or incidental costs. Round total costs to the nearest \$1000 in keeping with the "rough" nature of the estimate, and summarize the differences in costs among alternatives as a rough order of magnitude. Discounting would only be necessary if cash flows vary significantly in timing. Work to develop cost estimates with the appropriate base level functional expert, e.g., facility maintenance and new facility construction costs from civil engineering, number of dorm occupants by pay grade from base billeting office, BAQ/VHA costs from appropriate Accounting & Finance office. Documentation of costs is not necessary, but check calculations for accuracy.

6. Benefits. Identify the more important benefits associated with each of the alternatives being analyzed, e.g., renovation corrects all deficiencies, or opting for off-base housing (BAQ/VHA) results in demolishing old dorms, reducing facility maintenance and repair workload.

7. Risk Assessment. Identify the key variables which could possibly change to the extent that the recommendation would change.

8. Conclusions and Recommendation. Briefly explain which alternative appears best and why. Emphasize that the choice is based on preliminary analysis only and could possibly change based on results of a complete, formal EA.

Attachment 20

CRITERIA/STANDARDS FOR ECONOMIC ANALYSES/LIFE CYCLE COSTING FOR MILCON DESIGN

A20.1. Purpose. This guidance establishes criteria and standards for performing EAs and life cycle cost studies used in support of design decisions for MILCON program projects, i.e., to support the selection from various alternatives of components/systems being considered as elements in facilities design. These criteria and standards apply to all design decisions regardless of when they are made in the planning, programming, design and procurement process. This guidance does not apply to economic analyses and life cycle studies used to make project-justification decisions during the planning and programming process.

A20.2. General. EAs shall be conducted as part of the design process to ensure the selection/rejection of design alternatives is not based solely on construction costs, but also on least life cycle costs (LCC), that is, lowest total cost of ownership. The depth and degree of formality of these analyses shall be determined on a case- by-case basis to ensure that the cost of performing an analysis is clearly outweighed by the potential benefits derived. Results of generic studies or results of previous analyses of alternatives similar to those currently under consideration may be used in lieu of performing a new study provided the previous study was based on similar design conditions, criteria, and methods. Previous studies should be updated only as required to reflect changes of conditions significant enough to impact the design decision. All EAs and other justification for the selection of a design alternative, whether a previous study or a new one, shall be clearly documented in the appropriate section of the project design analysis.

A20.3. Methods. All analyses shall consider the total LCC for design alternatives, where the LCC includes all costs and benefits associated with an alternative over its expected life, including but not limited to construction/acquisition, energy, maintenance, operation, repair, replacement, alteration, disposal costs, and retention values. The present value discounting approach shall be used to adjust for the differences in timing of cost and benefits unless otherwise specified by other directives or by public law. The basic discount factor for finding the present value of a future amount is calculated

as follows:

$$\text{Discount Factor} = (1/((1+d)^n))$$

where d = the discount rate expressed as a decimal and n = the period (that is, n =1 for year 1, etc.) Discounting should be applied to all cost and benefits over the appropriate analysis period. Specific criteria are as follows:

A20.3.1. Discount Rates. The discount rates are expressed in "real" terms, i.e., over-and-above the rate of inflation for the economy as a whole.

A20.3.1.1. Energy Related Studies. All energy related economic (studies in which energy costs are relevant, regardless of their magnitude relative to other costs) shall use the current discount rate published by the National Institute of Standards and Technology (NIST) in their annual supplement to NIST Handbook 135, and disseminated by the appropriate Service Headquarters Office.

A20.3.1.2. Non-energy Related Studies. All economic studies other than energy related economic studies shall use the current discount rates published annually by the Office of Management

and Budget (OMB) as Appendix C to OMB Circular A-94, and disseminated by the appropriate Service Headquarters office.

A20.3.2. Analysis Period. The analysis period shall be the date of the study (DOS) through the economic life of the facility as a whole. The economic life shall not be taken beyond 25 years from the scheduled beneficial occupancy date (BOD) for the project unless specifically approved by the appropriate Service Headquarters Office. Such approval cannot be granted for energy related studies as it is precluded by statute.

A20.3.3. Cash Flow. In general, cash flow used in the analysis will be based on the estimated calendar dates on which the events and cost/benefits are projected/scheduled to occur. Construction/acquisition costs may be assumed to be incurred as a single lump sum, preferably at the time corresponding to the midpoint of the construction/acquisition process. Other cash flows that occur periodically throughout the year (e.g., cost of fuel, electricity, water, maintenance, etc.) may be assumed to be incurred as a single lump sum, preferably at midyear. In circumstances where the above assumptions add unnecessarily to the complexity of the calculations, all cash flows may be assumed to occur at the end of the year in which they are actually scheduled/projected to occur.

A20.3.4. Benefits and Costs. All benefits and costs will be expressed in terms of constant dollars that reflect the purchasing power of the dollar on the DOS (i.e., constant DOS dollars). The rate of inflation of the economy as a whole will be excluded from all LCC calculations. (The rate of inflation is irrelevant to the LCC analysis results since all benefits and costs are expressed in terms of constant DOS dollars and discounted using a "real" discount rate which reflects the time value of money over-and-above the general rate of inflation.)

A20.3.5. Future Benefits and Costs. In projecting future benefits and costs, an allowance for future price-level changes will be made only for particular benefits and costs expected to change at rates higher or lower than the general rate of inflation. In such cases, the rates of change used in the analysis will be the "differential" rates, i.e., the anticipated differences between the actual projected rates of change and the general inflation rate.

A20.3.5.1. Energy Studies: Fuel/energy costs shall have differential escalation rates as published by NIST in Handbook 135 and disseminated as indicated in paragraph 3.a(1) above. All non-energy costs shall have a zero differential escalation rate.

A20.3.5.2. Non-energy Studies: For non-energy studies, the differential rate of future price-level change shall generally be assumed to be zero, except in those cases where there is reliable information/data to the contrary.

A20.4. Computer Aided Calculations. All computer aided calculations for MILCON design economic studies will be accomplished using the Life Cycle Cost In Design (LCCID), a computer program developed by the U.S. Army Corps of Engineers Construction Engineering Research Laboratory (CERL), or a version thereof which has been certified by CERL as equivalent.

Attachment 21**CALCULATION OF INTERNAL RATES OF RETURN**

The internal rate of return (IRR) for a proposed investment project (e.g., a PIF or CSIP project) is equivalent to the maximum interest rate that could be paid on a loan to finance the initial investment, such that the net benefits of the project would provide for loan repayment. Put differently, the IRR is the discount rate that gives a proposed project a zero net present value. The formula for calculating IRR is contained in standard college finance textbooks. However, the IRR formula is an implicit function (i.e., it cannot be solved algebraically for IRR). Therefore, IRR can only be found by numerical iteration, best done with a computer program. A number of software programs are available to calculate IRR. Installation level analysts experiencing difficulty with this calculation should contact their MAJCOM financial analysis personnel, or SAF/FMCE, for assistance.

IRR LOTUS 1-2-3 PROCEDURE

Introduction: The following is an example of using LOTUS to calculate IRR. The same principles apply to other spreadsheets, such as EXCEL, though the commands would be different. LOTUS will calculate IRR for a virtually unlimited series of cash flows. However, LOTUS requires that a guess be made as a basis for the calculation. If the guess is not close enough so that LOTUS can arrive at an answer within a certain number of calculations (the closeness of the required guess depends on the number of cash flows, and also the version of LOTUS being used), then the calculation cannot be completed and an error message (ERR) results in the cell in which the IRR formula is entered. Since an analyst could spend a lot of time guessing at IRR (especially in the case of Productivity Investment Fund (PIF) and Component Sponsored Investment Program (CSIP) projects, IRRs can be quite high), it may save time to construct a spreadsheet which shows if guesses are resulting in a net present value (NPV) closer to zero. The following steps outline one suggested procedure:

1. Using the "Data/Fill" command, construct two separate columns for (a) the fiscal years (Column 1) and (b) the periods (0, 1, 2, etc.) of the project (Column 2). The year in which the initial investment will be made should correspond to "period 0." "Period 0" is a concept which captures the fact that an investment must be made prior to the realization of any savings. The term "period 0" (or "time 0") also indicates the timeframe of the analysis: analysis at any given point in time looks at a series of future cash flows.
2. Construct three more columns, entitled "Invest," (Column 3) "Save," (Column 4) and "Net" (Column 5). Again, the initial investment should correspond to "Period 0" in the period column. Any subsequent investments after period 0 should be made in corresponding subsequent periods (1, 2, etc.). The Net column (Column 5) should contain a formula equaling savings minus investment for each period. The negative sign in the Net column in period 0 shows the direction of the cash flow: an investment is an outflow of funds. To indicate that an investment must be made before savings begin, there should be no savings in the Net column corresponding to period 0. Now enter all investment and savings data under the appropriate column, either "Invest" or "Save."

3. Under the Net column (Column 5) (after the last cash flow amount), enter a formula in a cell to calculate IRR [`@IRR(guess, range)`]. "Guess" corresponds to the guessed discount rate; "range" enters the range of the cash flows in the Net column.

4. Since any guess may be too far off for LOTUS to reach an answer, it is helpful to add two more columns to the spreadsheet. The column after "Net" is "Discount Factor" (Column 6). Here the formula for a discount factor is entered $[(1+i)^{-n}]$, where i = interest rate and n = period. [Note: This formula does not reflect midyear discount rates. For IRR calculation it is not necessary to use midyear discount rates.] A cell may be assigned to hold an interim interest rate, such as 10%, so that it can easily be recognized that the formula is correct and is producing the correct discount factor (i.e., the end-of-year discount factor for one period at 10% is .90909).

5. The last column is "Discount Factor * Net" (Column 7), which multiplies Column 5 by Column 6. At the bottom of Column 7 enter a formula to add the results of the column [`@SUM(range)`]. The result of this calculation is the net present value. Formatting this cell to three decimal places is recommended. (If not formatted, scientific notation may result, which would make it more difficult to determine when the IRR guess is approaching zero NPV). Since the IRR is the discount rate which makes NPV equal to zero, it can now be determined from the NPV cell if successive guesses at a discount rate (by changing the value in the cell to which the discount rate has been assigned on an interim basis in step 4 above) are approaching zero.

6. When a guess looks like it is getting reasonably close, substitute this "guess discount rate" into the IRR formula in the cell at the bottom of the Net column (Column 5) [e.g., `@IRR(guess, range)` or `@IRR(1.2,C4..C15)`]. Provided that the guess is close enough to make the calculation within a determined number of calculations, LOTUS will then calculate IRR. When LOTUS has calculated IRR, the formula in the Discount Factor column (Column 6) may be changed so that the discount rate used (i.e., "i") refers to the cell in which IRR is calculated. After this revised formula is copied to all cells in this column (Column 6), the result should be a NPV of zero. The cell in which the interim discount rate was located may be erased. NPV of zero confirms that the IRR LOTUS has calculated is a correct mathematical solution to the problem. Note: Multiple answers, negative answers, or no answer at all are possible for IRR. If there is not both an outflow and an inflow of funds, no answer will result. Multiple answers are possible if there is an investment in the outyears (i.e., after an initial series of investments). However, this is not the normal pattern in the case of government projects, in which investment is usually limited to one initial investment or an initial investment with one or two subsequent investments in the years immediately following. Negative answers may result if (1) the investment is not profitable or (2) the result is mathematically possible (due to "n" in the discount factor formula being an odd number during odd-numbered periods). If the investment intuitively appears to be profitable, yet a negative IRR is the result, other positive solutions are possible which should be sought by further substitution of discount rates. With experience an analyst should be able to discern when a negative solution is a mathematical possibility but not within the relevant range: i.e., when a positive solution should also be sought.

Attachment 22

FUNCTIONAL ECONOMIC ANALYSES (FEA)

A22.1. FEAs, or "business case analyses" are required for programs (i.e., new starts) planning to use an automated information system (AIS) as any part of the preferred solution. An AIS is defined as a combination of information, computer, and telecommunications resources which collects, records, processes, stores, communicates, retrieves, and displays information. **NOTE:** The procedures here do not apply to AISs that are integral to or embedded in a weapons system, or that are used exclusively for cryptographic activities. In general, command and control, research and development, and intelligence programs are exempt from the FEA requirement; program offices are responsible for performing cost and operational effectiveness analyses (COEAs) for weapons systems or life cycle cost benefit analyses for AISs.

A22.2. The manager of a DoD business function (OSD Principal Staff Assistant (PSA)) initiates an FEA. The manager may delegate responsibility for an FEA to one of the military services or to a program office. An FEA is mandatory for all potential Major Automated Information Systems (MAIS) programs, and are used for non-MAIS programs at the discretion of the Milestone Decision Authority (MDA). The MDA makes the FEA determination at the Milestone 0 review.

A22.3. The preparation and validation of data for an FEA is the responsibility of the functional user. Comptroller financial analysts provide assistance in the calculation of financial measures and the proper use of discounting and inflation adjustments. Communications-computer systems staffs can provide assistance in determining costs of proposed technical solutions. The PSA tasks a preliminary FEA prior to Milestone 0 approval. The purpose of an FEA review at Milestone 0 is to validate the scope and magnitude of the AIS program within the context defined by the FEA. As more information is gathered and requirements further defined in the Concepts Development Phase (Life Cycle Management Phase 1), the FEA is further refined, developed and validated. The FEA serves as a tool to select the best program concept to satisfy a mission need based on the results of combining the evaluation of functional and technical alternatives with their related costs and benefits. The final FEA is presented at the Milestone 1 review and updated for subsequent milestone reviews. The Secretariat or Air Staff functional advocate and SAF/FMCE (at the request of SAF/SCX or the functional advocate) review FEAs prior to the Milestone 1 review. SAF/FMC will convene the Air Force Cost Analysis Improvement Group (AFCAIG), as required, to review all cost documentation. The Air Force Acquisition Executive (AFAE) is the approval authority for FEAs. An FEA is a management decision tool. FEAs emphasize looking at the overall business process involved in an operation or future mission need in order to recommend the best way of doing business. Therefore it is important not to focus merely on a particular investment, but how the investment fits into the larger picture of improving business operations. While FEAs are a type of EA, an FEA has certain characteristics which distinguish it from a "regular" EA, including the "overall business methods" perspective addressed above and emphasis on projected hard budgetary savings, the post-implementation tracking of claimed savings into executed budgets, risk (or sensitivity) analysis, and recommended use of the Institute for Defense Analysis' (IDA) Business Case Analysis Model to produce summary reports. Though the IDA Model is not required, it is recommended for standardization of reporting to OSD. An FEA summary report (generated by the IDA model) summarizes the FEA results for proposal presentation and forwarding. FEA summary reports must include, as a minimum, the following exhibits generated by the IDA model:

- A Baseline Cost to Alternative Cost Comparison.

- A Risk Adjusted Discount Cash Flow Analysis. The FEA itself must meet the documentation requirements of AFI 65-501 and support all costs contained in any corresponding FEA summary report.

A22.4. FEAs generally follow the principles of economic analysis contained in this manual. The following guidance represents some of the basic elements of "regular" EAs in terms of FEAs:

- *Executive Summary.* A concise summary (preferably one or two pages) summarizing the remaining elements of an FEA, outlined below:
- *Objective.* A brief description of the mission need in terms of the functional process being improved. Emphasis should be on mission need/impact, not on any specific technical solution.
- *Statement of Assumptions/Constraints/Ground Rules.* A description of all major assumptions in the analysis, any legal or regulatory constraints, and ground rules which form the context of the analysis. Significant sources of data, costing procedures, inflation factors or projected workload should be stated here.
- *Description of Alternatives.* A description of the current process (i.e., the status quo or baseline) and all of the proposed process improvement alternatives. Often the status quo/baseline involves some revision or upgrade of the current operation, yet is still generally referred to as status quo. The role of any current support of an operation by automated information systems should be adequately described, as well as major benefits offered by alternative systems. Any rejected alternatives should be fully explained.
- *Determination of Costs/Benefits.* A presentation of all costs for each feasible alternative using the cost element structure in the IDA FEA model or MAISRC cost element structure. Make sure to document sources of all costs and calculation down to most basic inputs to allow complete replication by reviewers. Savings (the difference between the recommended alternative and the status quo/baseline) should result in future budgetary reductions for the operation. Both nonmonetary and monetary costs and benefits should be included in the analysis. Analyses involving substantial differences among alternatives should include a benefits analysis in which benefits are addressed more fully and quantified to the extent possible. A weighting scheme is recommended for analysis of benefits, if possible. Note: One difference between the FEA and the FEA report is that the IDA model used for the FEA report generates inflated dollars, whereas FEAs (and EAs generally) are ordinarily expressed in constant dollars.
- *Sensitivity/Risk Analysis.* Variation of the assumptions used in the analysis (e.g., key variables such as major cost drivers or interest rates).
- *Recommendation.* The recommended course of action should be clearly indicated and supporting arguments summarized.

NOTE:

Contact SAF/FMCE for additional guidance on BPI analysis and FEAs

Attachment 23

ANNUAL ECONOMIC ANALYSIS REPORT (RCS: HAF-FMC[A] 9501) FORMAT

Command/field operating agency financial analysis offices forward this report to SAF/FMCE by 1 December annually, reporting on economic analysis activity of the recently completed fiscal year. This report provides the input for the metric found in AFPD 65-5. This report is designated emergency code C-2. Continue reporting during emergency conditions, normal precedence. Submit data requirements in this category as prescribed or as soon as possible after submission of priority reports. Discontinue reporting during MINIMIZE.

1. Number of EAs completed by the command/field operating agency during the past fiscal year.

NOTE: "Completed" means the EA has been certified by command headquarters. For FOAs or direct reporting units, "completed" means the EA has been fully coordinated within the FOA/DRU.

2. Of the total in Question 1, the EAs were of the following types:

MILCON_____

MFH_____

PIF/CSIP_____

FEAs_____

AIS_____

DBOF_____

OTHER_____

TOTAL_____

Key: MILCON = military construction; MFH = military family housing; PIF/CSIP = Productivity Investment Fund, Component Sponsored Investment Program; FEA = functional economic analysis; AIS = automated information systems; DBOF = Defense Business Operations Fund

NOTE: If the TOTAL in Question 2 does not match the response in Question 1, please explain. For example, some PIF/CSIP EAs may support MILCON or AIS projects, and could be reported under both categories.

3. Of the EA total in Question 1, how many required forwarding to Air Staff/Secretariat?

4. Of the EAs submitted to Air Staff/Secretariat the *previous* fiscal year (i.e., the year before the fiscal year reported in Question 1 above), how many fit in the following categories?

No revisions required: _____

Minor revisions required _____

Major revisions required _____

Project canceled/delayed, no action taken: _____

Other: (explain) _____

Note: Minor revisions take up to five hours direct labor, not including computer time for processing or printing, or time in coordination. Major revisions take more than five hours. Revisions here refer to those resulting from Air Staff/Secretariat review, not those required of a base or wing by a command headquarters.

5. Of the EAs in Question 4 above, which fit into the following categories:

No revisions required:	MILCON_____	MFH_____	PIF/CSIP _____	AIS_____
	OTHER_____			
Minor revisions required:	MILCON_____	MFH_____	PIF/CSIP _____	AIS_____
	OTHER_____			
Major revisions required:	MILCON_____	MFH_____	PIF/CSIP _____	AIS_____
	OTHER_____			
Project canceled/delayed,	MILCON_____	MFH_____	PIF/CSIP _____	AIS_____
	OTHER_____			
no action taken:				
Other:	MILCON_____	MFH_____	PIF/CSIP _____	AIS_____
	OTHER_____			

6. List the number of EAs which required revisions, either minor or major, due to:

	Minor	Major
Revising the objective of the analysis (e.g. quantifying more specifically):	_____	_____
Revising or clarifying assumptions:	_____	_____
Adding another alternative:	_____	_____
Substantially revising an alternative:	_____	_____
Explaining why one or more alternatives are infeasible:	_____	_____
Changing investment cost, e.g., due to a change in DoD Form 1391 costs:	_____	_____
Providing or improving documentation:	_____	_____
Adding sensitivity analysis:	_____	_____
Adding a benefits analysis:	_____	_____

Adding a category of cost (cost element):	_____	_____
Revising the method of estimating a cost element:	_____	_____
Adding a cost/benefit analysis:	_____	_____
Updating discount rate or inflation factors:	_____	_____
Adding missing signature coordinations:	_____	_____

NOTE: Total may not match totals in Question 4 due to revisions of an EA for more than one reason.

7. Estimate the amount of direct work hours required to complete an economic analysis. This question refers to the time an analyst spends completing an EA at base level, not coordination time at base level, or command headquarters review and coordination, or any later revisions. _____

8. Estimate the total time it takes, on average, from the time an EA is requested until:

a. Completed at base level (including coordination) _____

b. Reviewed and coordinated at command headquarters. The time here should include the time in a. above. _____

NOTE: This question refers not to direct work hours, but to the total time required to complete an EA, including waiting on data inputs while other work is being accomplished.

9. List the number of preliminary economic analyses (see AFI 65-501, paragraph 2.2.5) completed in the command during the fiscal year just completed: _____

10. List the average estimated time to complete a preliminary economic analysis. _____

11. DBOF investments of \$25,000 up to \$100,000 require a cost analysis, which is not as developed as an economic analysis (required for DBOF investments of \$100,000 or more). DBOF EAs are reported in Question 2 above. List the number of DBOF cost analyses completed by your command/FOA in the most recently completed fiscal year. _____

12. Of the total number of EAs in Question 1 above, list the number of EAs completed by:

In-house personnel: _____

Contractors: _____

13. Referring to Question 12: if any EAs were completed by contractors, indicate the average cost to complete one EA by contract (express in 1000s, rounded to one decimal point). _____

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